SIGNALS

JOURNAL OF THE ARMY SIGNAL ASSOCIATION • DEDICATED TO MILITARY PREPAREDNESS

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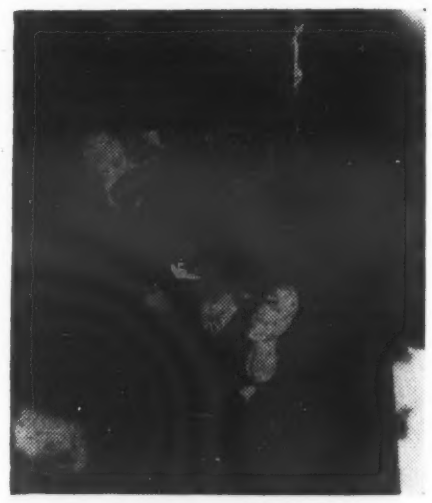
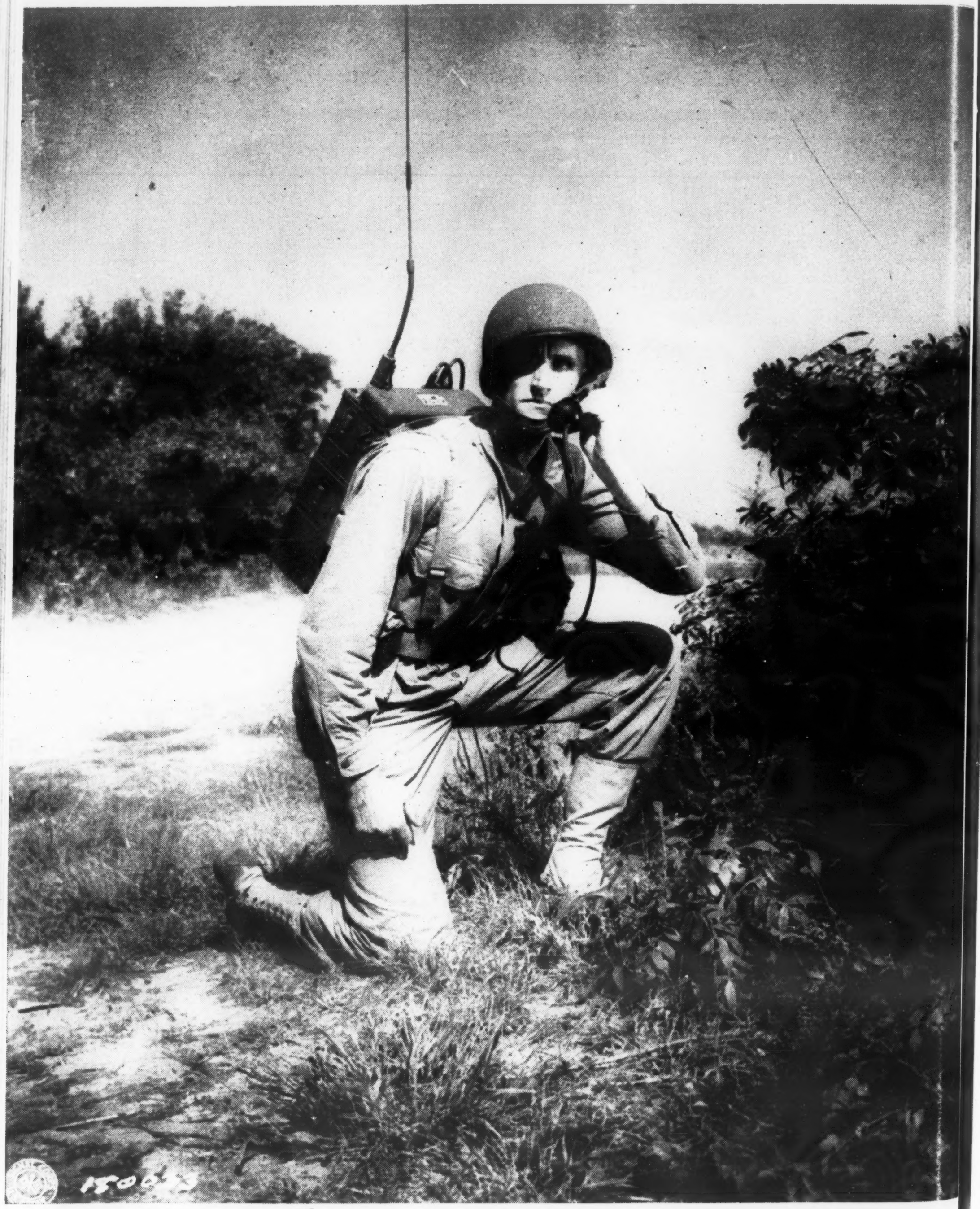
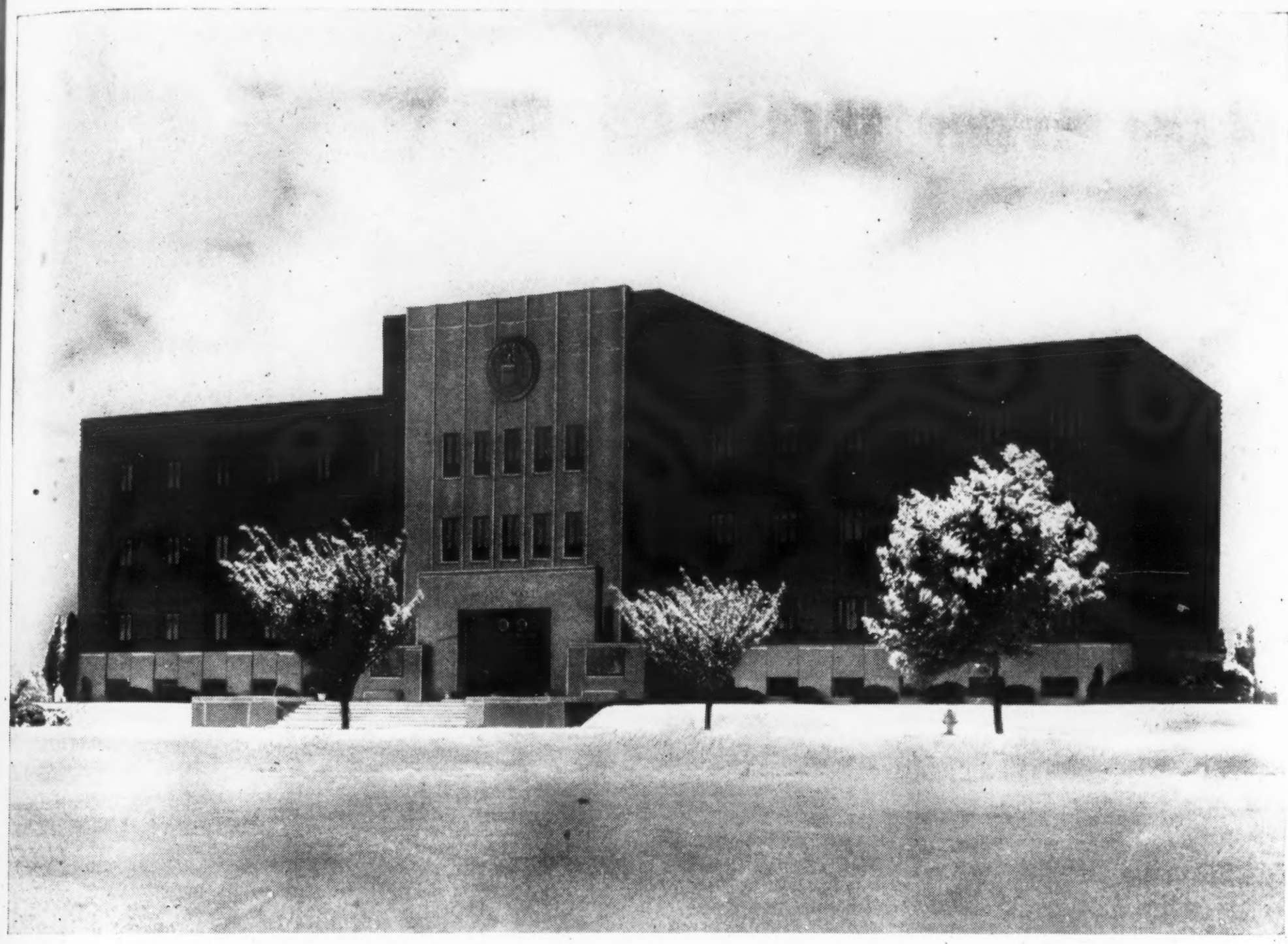


The Cover

Pvt. Angelo Savarese of Philadelphia, on Guam, June 1945.



Signal Corps soldier operating an FM "walkie-talkie" in training at Fort Monmouth.



Training at Fort Monmouth, World War II

By Brigadier General W. O. Reeder

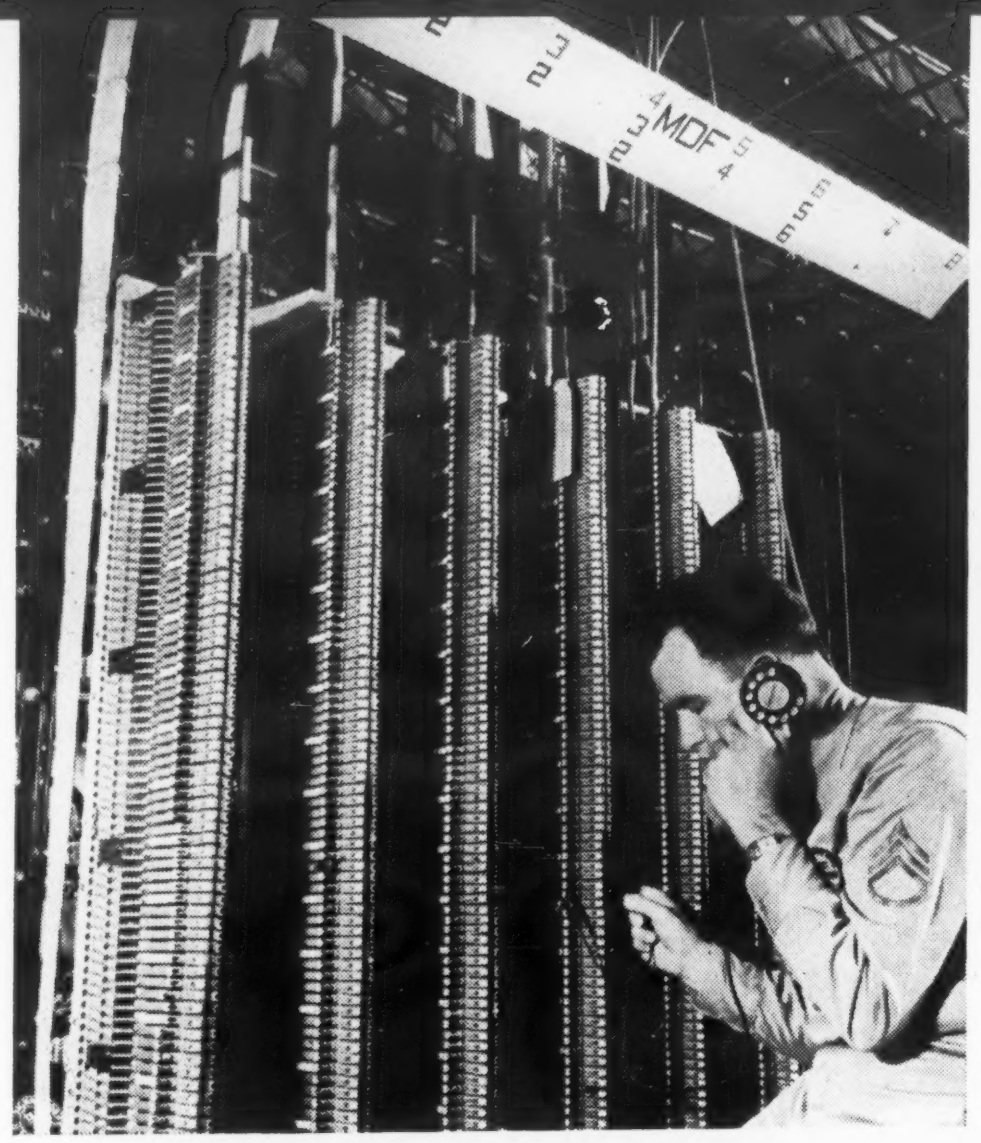
Deputy Chief Signal Officer of the Army

FIRST STEP in the wartime expansion of the Signal Corps School occurred in June 1940. A Washington directive increased enlisted student capacity to 800, effective 1 January 1941. The directive was typical of the many that followed. New school buildings and new barracks were needed; more equipment and additional instructors had to be procured; the time allowed was short.

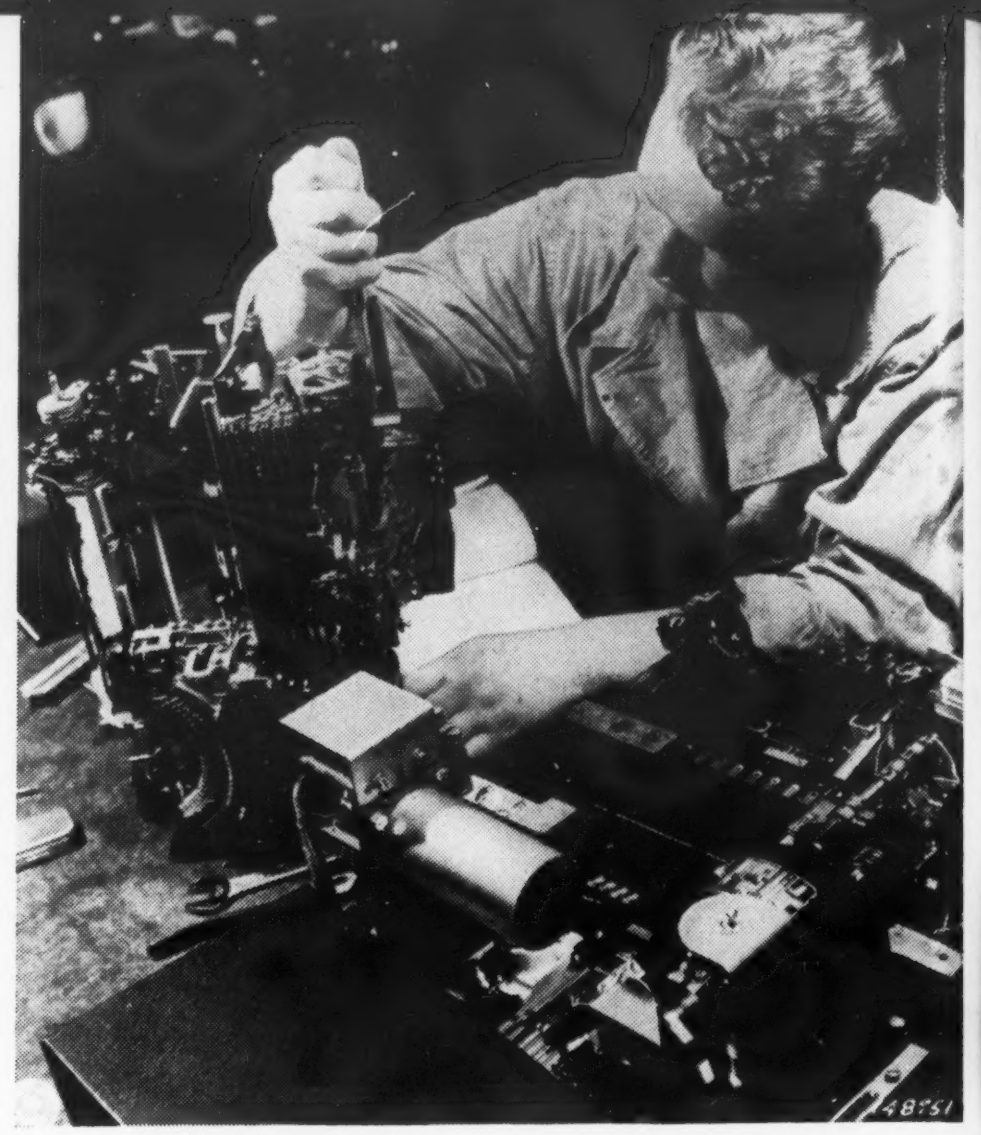
Months before January first, the flow of incoming students began at the increased rate. War was just over the horizon and the insatiable demand for trained men had begun. That demand was always far ahead of the supply. The result was three years of almost continuous crisis at Fort Monmouth. Qualified instructors were few and new ones could be had only by filtering off a part of the school output. Equipment was scarce and the field requirements prevented Monmouth from ever having sufficient. Frequently the equipment for a new course came in the back door at the same time that students for the course were entering the front door. Instructors had no time to prepare. There were even occasions when the students arrived but the equipment did not; instructors had then to improvise as best they could. The school buildings were jammed. While construction was in progress, there was the mud to contend with. Often men were quartered in unfinished barracks.

Beginning

Under such circumstances, training could not be perfect. However, Monmouth-trained officers and men were able to more than do their share in building the greatest signal communication system the world has ever known. This result was due to no one man or group of men; it was due to every officer and man who



Trainee testing hand phone on main frame.



Teletype repair was in Monmouth curriculum.

participated in the training job at Monmouth. In peacetime a fine tradition of training had developed in the Signal Corps and was centered at Fort Monmouth. As the school and post expanded, the old hands accepted greater responsibilities and at the same time offered what they knew to those who joined them. The spirit was quickly absorbed by all who came to Monmouth, whether from the Reserve, the Guard or civil life. It was the fine cooperation, the splendid initiative, and the loyal determination of *all hands* that made Monmouth successful in sending out men who could and would get the message through.

In the summer of 1940, four new signal companies had been formed at Monmouth. As they filled with recruits, the Enlisted Department took the additional load of school training for them. Unassigned recruits also flowed into the Post in unprecedented numbers and many of these helped to fill the classrooms to capacity. About this time was made the basic and vital decision to abandon training of enlisted men as all-around radio or wire and to break both wire and radio down into lesser specialties. This shortened the school training period, automatically increased student capacity, and allowed the output to be available sooner to the field. The further breakdown of specialties and the addition of new ones because of new types of equipment continued and the process brought the total number of school trained specialties to over thirty by the middle of the war.

The Officers Department of the School followed the same practice. Initially it dropped general training in favor of wire and radio specialties. Later, the number of different courses had to be increased. In 1940 and 1941, how a student officer was trained was not so material, for there were far too few to train. We were at peace and Reserve Officers could be called to active duty only with their consent. Possible loss of seniority rights was a powerful deterrent to many who otherwise would have been glad to serve. After Pearl Harbor the need for officers in the field was so great that few could be spared to train before taking up their duties. Insignificant as peacetime training of a reserve officer may have been, that little made him a one-eyed man in the kingdom of the blind. In late 1942 and especially after that year, the Officers' School made a great training contribution but the splendid work that might have been done in preparing officers *before* mobilization, was lost. The contribution of the Officers' School was too little and too late.

At the same time that the Officers' School was giving a month refresher course in nearly empty classrooms, a new demand for commissioned personnel developed. In August 1941, the War Department directed that Monmouth establish a replacement training center with a capacity of 5,007, to begin operation April 15. Officers already on duty at Monmouth did the initial planning.

No officer in the Signal Corps was better qualified than General Reeder to plan and direct the expansion in training at the Signal Corps School brought about by the pre-World War II emergency and the war that followed with the resultant tremendous needs for specialists for World War II Armies. He had spent six years as student and instructor at the School before he returned there in 1940. A graduate of the U. S. M. A., he later was an instructor there for five years and has a Master of Science degree from Sheffield Scientific School at Yale. During World War II he was commandant of the Schools at Fort Monmouth which trained thousands of communications officers, enlisted specialists and officer candidates, until his departure for the China-Burma-India theater in 1944. While commandant of the Schools he introduced many unique training procedures which demonstrate his progressive viewpoint toward efficient and rapid training. For his work there he was awarded the Legion of Merit to which an Oak Leaf Cluster was later added for his work in the CBI theater. He is now Deputy Chief Signal Officer of the Army.

Monmouth students were taught radio repair and pigeon handling.

A few were ordered to take over preparation for the training center but the full complement of officers was not available until after the replacement center was in operation at capacity. Nonetheless, building was begun. courses planned and equipment ordered. Enlisted training cadres arrived slowly. They were green and were to have had school training before the Center opened. Their arrival was so late that the School had to improvise "quickies" for them. Officer cadre was the same. Long before the training center was due to open, its trainee capacity had been increased another thousand and more buildings were planned. A fundamental decision was made not to duplicate in the RTC any specialty training already set up in the School. Instead, 710 men from the RTC were to be enrolled in school courses. As a result the student capacity of the Enlisted School was increased to 1,510 and it continued to expand.

At the beginning of 1941, the Officers School was very lightly loaded, except for a special course for the officer cadre of the RTC. The Enlisted School was bulging with students, was short of instructors and equipment and was occupying its new buildings as fast as they were completed. The RTC area was a sea of mud.

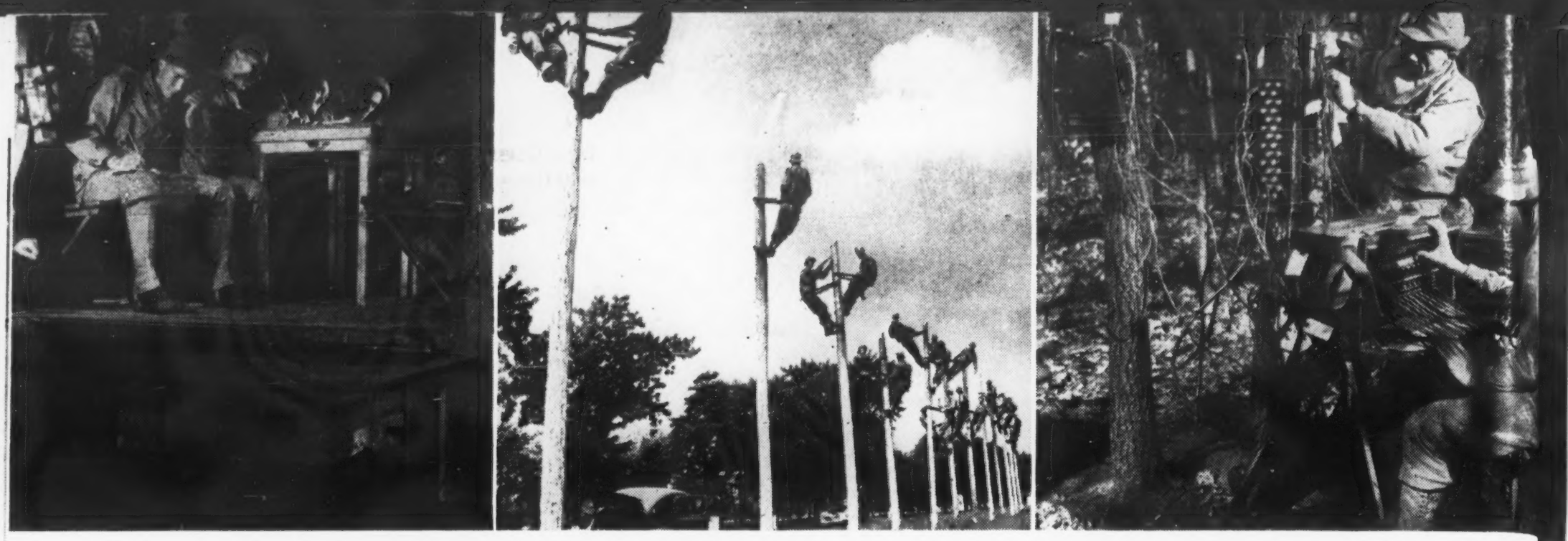
At this time, the War Department decided to open the RTC as rapidly as "essential housing" became available. The phrase was simple but deceptive. The emphasis in construction was on "essential housing," but that does not include roads, warehouses, or training facilities. Late in January, "essential housing" for 800 was reported complete. At that time bunks, bedding, equipment, etc., for 7,000 men were arriving and because no RTC warehouses had been built, a lot of this had to be stored in the barracks which were finished. The 800 trainees who arrived in February found their barracks already occupied as warehouses. No training facilities had been built for them; the cadre was short and green; the RTC area was Monmouth mud at its worst. From this time on, replacements arrived as fast as essential housing was completed. A more discouraging training situation could scarcely have been arranged. Company commanders in the field reported that replacements from Monmouth in June of 1941 were not well trained. The wonder is that they were trained at all. Every day, however, the RTC dug itself a little further out of the mud and established its training a little more firmly.

O.C.S.

In January 1941 the first plans for the Officer Candidate School at Monmouth were made. To clear space for it and for additional enlisted students, it was decided to move all tactical units to other posts. A curriculum was outlined for the 500 candidates due to arrive 1 July, but it is indicative of the officer shortage prevailing that not until the first of April could any officers be secured to begin active planning. At that time, the Commandant released his aide for the OCS and four entering students, who had military experience varying from

CCC duty to graduation from VMI, were diverted from the class to join in preparation for the first OCS class. Another officer was added to the group on the first of May and on the first of June the Assistant Commandant reported for duty. On June 20 eighteen officer students were graduated early and given until July 5 to prepare their courses and classrooms.

While all this was happening, another training activity was taking form. The need for trained maintenance men for aircraft warning (later called radar) was apparent, but the means for training were obscure. The equipment was super-secret, there was no literature to teach from and very few knew the equipment if it had been available. In March an extremely well qualified officer was taken from the Department of Training Literature, an officer and a non-com obtained from the



(Left) Mobile message center in the field. (Center) Signal men learn to climb telephone poles. (Right) Field switchboards used in basic training.

First Aircraft Warning Company, several engineers borrowed from the Labs and the group sat down together to puzzle out the workings of the equipment and then to devise a course. The course began in May, working on a borrowed SCR-270. The proposed student load was ten officers and forty enlisted men. Special buildings had been planned and were already under construction when a Washington directive confirmed the actions already taken. That directive set the student capacity at 400 overall.

The OCS opened on schedule and 500 students began a gruelling three months. In that time a student could not be qualified technically and also in the basic, common duties of an Army officer. It had been decided to give first priority to the basic training essential for an officer and crowd any spare time with technical work. The curriculum was elementary but there was a lot of it. Eight hours of classes with drill, calisthenics and parade additional, meant that sleep had to be sacrificed in order to study. The pressure thus applied to the candidate was intentional. If a man could not stand OCS for three months, he would be little likely, as an officer, to think first of his men and his job at those times when he was under stress, uncomfortable and harassed. The load on the student was no worse than that carried by the instructors of the first class. The teaching stint was four hours daily for the weakling, six hours for the more robust. Drill, calisthenics, parades, marking papers and supervising study were additional duties. But the plans for the school worked; each class was met in the designated classroom at the appointed time by an instructor ready to teach.

Electronics Training Group

While the first OCS class was struggling toward graduation, a novel training activity was opening at Monmouth. Farseeing leaders had recognized that we would eventually enter the War and that Britain was our overseas outpost. To bolster the British effort was in our interest and a means to do so was found in the Electronics Training Group. This group consisted of radio specialists recruited from civil life, commissioned in the Signal Corps, sent to England to learn radar and to help in the defense of Britain, if possible. As it worked out our country gained far more than did the United Kingdom. When the plan of the ETG was conceived we were at peace, and the whole process was cloaked in great secrecy. Monmouth's part in this program was to receive a section of fifty ETG officers every three weeks, process from civil life to officer status and give them as much training as possible. The program never ran on schedule. Sections arrived irregularly, left still more irregularly. The backlog awaiting transpor-

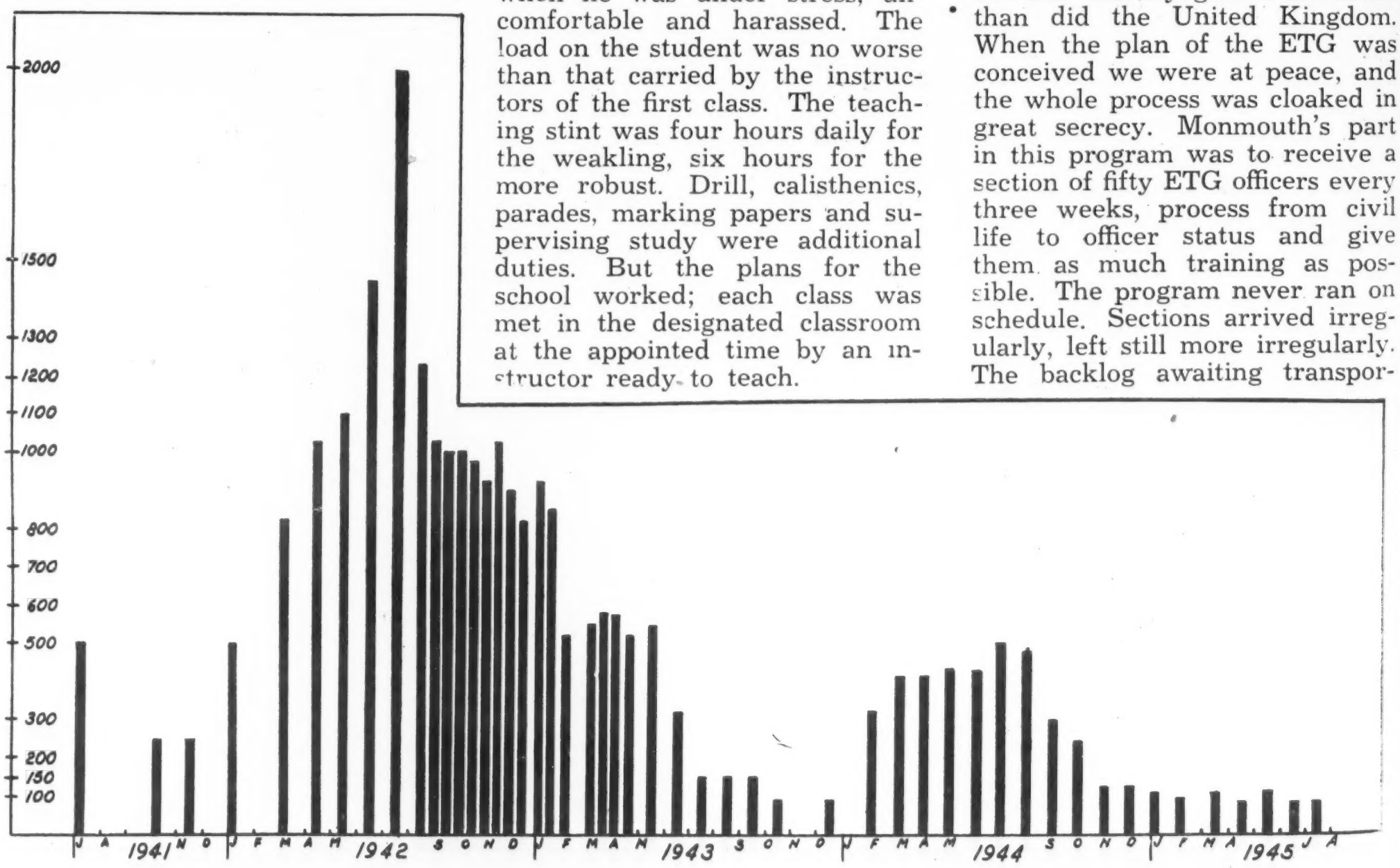


Fig. 1. Size and frequency of classes entering OCS at Fort Monmouth.

tion became so great that eventually the ETG's had time to get quite a lot of school training at Monmouth and even at Harvard before going across. The ETG training at Monmouth was sketchy at first but improved steadily as the objectives emerged from the cloak of secrecy. After their tour in England, the ETG's returned to Monmouth before proceeding to other duty and many paused then to obtain the Signal School training that they missed before going overseas. The ETG program was not an unqualified success, but it did definitely contribute to our later success in radar.

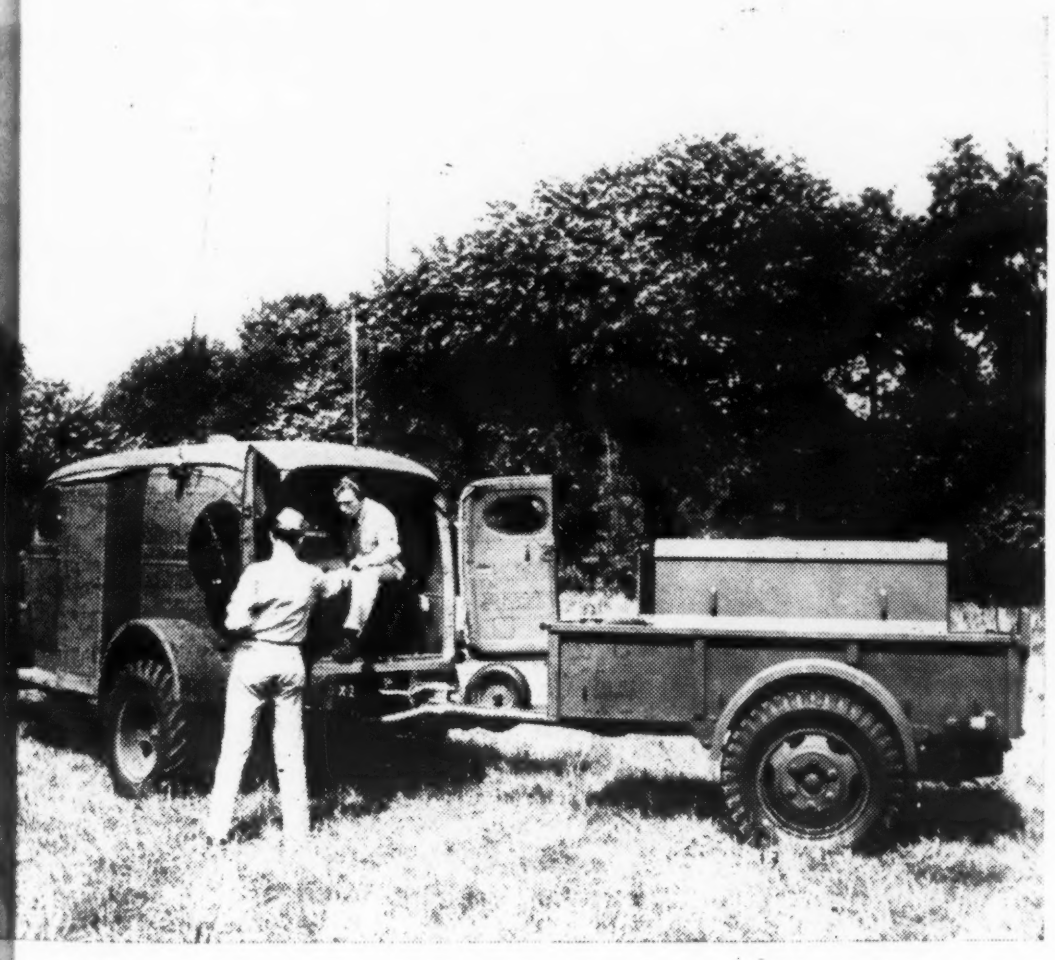
The demand for graduates of the Aircraft Warning School was growing apace and before the original school buildings were completed, plans for further expansion had been drawn and submitted. In October, Washington increased the student capacity of the AWS to 900, and to provide the necessary housing, reduced the capacity of the RTC. This last was an unfortunate move because the crying need for trained replacements caused the RTC input to continue at the same rate. Monmouth was being jammed with personnel but winterized tents took up the overflow. The RTC training improved steadily and its output grew to 13,000 by Pearl Harbor. The Enlisted School was running full and adding new courses as the need was foreseen. The Officers School was ill-equipped and short of students, who were often ordered away before they could finish their courses. Before the first OCS class graduated, it was decided to stagger classes in this school so as to develop a continuing tradition. The second class, which entered was 250 and a like number entered six weeks later, in November. This school too was proceeding more smoothly. All schools were getting more equipment and instructors, though none had nearly enough. This was the situation when December 7th brought the war.

Into War

Reaction to Pearl Harbor seemed intolerably slow at Monmouth. Everything expanded except the Officers School. The additional construction for the AW school, which had been hanging fire in Washington, was not approved until January. The January OCS class was 500 instead of the 250 previously scheduled. Monmouth took quick steps to prepare for the expected mushrooming of all activities by obtaining the use of the New Jersey National Guard encampment at Sea Girt. Construction there was begun promptly enough to permit a battalion of the RTC to move in on April 4, 1942. As construction was completed more moved down, and eventually Camp Edison, as it was re-named, housed all that part of the RTC which was engaged in basic military training.

It was the demand for officers that caused the greatest expansion and the greatest stress. The OCS was built up at an unprecedented and unbelievable rate. Facilities originally planned for 500 were enlarged in the course of eight months to accommodate 6,000 officer candidates. Figure 1 shows the size of entering classes and the dates of entry. It can be seen that the demand for officers was met before the end of 1943, that there was a moderate resumption of activity in 1944, and that by the end of that year the OCS had done its job. Thereafter it functioned to provide a few replacement officers and to offer incentive to deserving enlisted men.

The year 1942 was one of terrific strain at Monmouth. The OCS expanded from an enrollment of 250 on January first to 4,000 six months later and to over 6,000 two months after that. Such growth required additional construction and was complicated by the fact that other activities were growing, too. The Aircraft Warning School continued to expand and the barracks which were a part of its facilities were occupied before they were finished. The space at Monmouth was filled with new construction, recruits continued to pour into the RTC at a rate far exceeding its authorized capacity and a new area had to be found. In April Camp Wood was purchased and construction begun. As rapidly as



The SCR-299 provided field radio experience for students.

These men were instructed in the Morse code.

Radio furnished voice communication for maneuvers.

barracks there could be occupied, the RTC was moved into it until in the late summer all of the RTC activities were at Camps Edison and Wood and both places were overcrowded. In spite of this, RTC training continued to improve.

The Florida Migration

The congestion at Monmouth and the foreseeable demand for radar men caused plans to be made for moving the Aircraft Warning School to a new location. The site chosen was Hobe Sound, Florida and there Camp Murphy was built. Even while the camp was building, the school began to move from Monmouth, occupying at first a warehouse rented in West Palm Beach. Although the school operated in Florida beginning in July, the move was made gradually and instruction was conducted at both Murphy and Monmouth for months. The space which the school vacated was sorely needed and was required before it was available. The increased demand for school trained enlisted men had been also foreseen and in the spring of 1942 Monmouth furnished the cadre for a new Enlisted School at Camp Crowder, Missouri. The spirit of the Monmouth officers and men who formed the cadre is shown in the speed with which the new school was opened and in the magnificent record which it made. And in the summer of 1942 cadres from both Monmouth and Crowder were combined to establish the new Western Signal Corps Training Center at Camp Kohler, California.

The Officers School began to pick up in the summer of that year. Early OCS classes had to be sent to the field as fast as they graduated, much as they might need further training in the Officers School. However, in each succeeding class a larger proportion was retained at Monmouth for enrollment in the Officers School. Also entering the school were large numbers of officers commissioned directly from civil life and the officer cadres of affiliated units. All of these swelled the enrollment until the Officers School burst its bounds. In September a hotel, an apartment house, the YMCA, the Convention Hall and a shore dinner restaurant were leased in Asbury Park and a considerable part of the Officers School began functioning there. Innumerable difficulties were involved and no one who attended classes in Asbury Park will ever forget the problem of controlling the acoustics in the Hall. At this time the Officers School was giving training in five specialties, a "common" course, an advance course, cadre training, and a combat course, in addition to the ETG program.

Because of the great numbers of OCS graduates and other officers who were to be assigned from Monmouth, the practice of tabulating qualifications and filling officer requisitions had grown up as a function of both Officers and Officer Candidate School. In 1942 it was set up as an independent activity. Some of the success which signals obtained in the war was due to the care with which the Classification Department personnel strove to fit the right man into each request from the field.

Winter 1942-43

The end of 1942 and the beginning of 1943 found a fluid situation. The Aircraft Warning School was nearly gone; the OCS was operating near its peak but expected enrollment to decrease in 1943; the Enlisted School was full and growing; the Officers School was jammed and functioning under difficulty; the RTC was full but well settled into an excellent routine. As 1943 wore on, relief from overcrowding began and enabled both the Officers and Enlisted Schools to occupy more space and thereby improve their facilities and instruction. The decrease in the OCS

allowed release of Asbury Park facilities a little over a year after they had first been occupied. The Enlisted Men's School expanded by Washington directive to a student capacity of 9,000. Instruction in all schools improved steadily and more equipment was available for teaching. Meanwhile, the training objective was shifting more and more and the RTC began to decrease its operations in May 1943. In July the last group of RTC trainees arrived. The Center trained during its existence over 60,000 replacements. The space which it had occupied was immediately filled by the Unit Training Center.

No units were trained at Monmouth from early 1941 when tactical units left the Post in order to make room for OCS. However, in late 1943, there was activated the 822 Signal Fixed Radio Company in order to give team training to fixed radio station teams assembled from trainees at Monmouth. This activity remained small until inactiviation of the RTC freed facilities. The training of signal units in scattered locations had not been entirely satisfactory, whereas good results had been obtained in the Unit Training Center at Camp Crowder. A Unit Training Center was activated at Monmouth on 10 August 1943 and enlarged as the RTC closed out. By October of that year the personnel of units in training totalled over 4,400. The UTC rapidly expanded its activities over a good part of New Jersey in order to give units experience in operation at nearly full distance. When V-J Day came, the UTC had trained 46 companies, 26 battalions, 79 teams, 56 platoons; the lot totaling over 25,000 personnel. As with every training activity at Monmouth, the efficiency curve of the UTC was steeply upward. The cadre put the training of units squarely up to the unit officers but gave supervision, training aids, and assistance in POR.

The OCS enrollment dropped during 1943 because of smaller classes at less frequent intervals. The character of the student body also changed. Beginning in January, ROTC students completed their training by attending OCS and later, ETG members who had not yet been commissioned did the same. Most of the remainder were returned overseas personnel and the disparity in background of the students made instruction difficult. By pinching bits of time here and there, a field exercise had been added to the OCS curriculum in August 1942. Nearly a year later, ASF recognized the correctness of this move by adding a month to all OCS courses and directing that the additional time be spent in field work.

The demand for overseas personnel was felt strongly in 1943 and there was a constant struggle to prevent training cadres being cut too deeply in the effort to provide men for theaters. There was also insistence that men who had been serving only in the United States, go overseas. This seemed logical but was very dangerous to the superb training establishment whose members had been selected so carefully and could not be replaced in a short time. The contraction made it economical to place both OCS and Officers' School under one head. Both schools were well below their wartime peaks and the merger also produced better coordination between the courses of the two schools. An innovation in the Officers School in December was the first class of WAC officers. These proved to be of excellent caliber and fine students and their attention to detail soon made instructors forget notions of male superiority as they sought answers to unexpected questions. WAC's had previously made their appearance on the Post to relieve men for overseas shipment. These girls were doing a fine job in the offices and elsewhere.

Publications

In November an old activity at Monmouth changed its name and secured a new lease on life. The Department of Training Literature had been a part of the School for years and had been responsible before the war for writing training and technical manuals. The speed at which equipment was developed and produced during the war had made efficient operation of the Department almost impossible. The various laboratories were attempting to get technical manuals written but with very indifferent success. The role of the DTL was reduced to editing and it had difficulty in accomplishing that. It did take up with success the writing of film and film strip

Gen. Reeder—trainer of signalmen for air, ground and service missions.

plans. However, the muddled training literature situation caused by ill-defined responsibilities became alarming by the middle of 1943. For example, no technical manual had been produced for any radar set and the troops found many technical manuals impossible to use for maintenance. In November the Fort Monmouth Signal Corps Publication Agency was activated. It was formed of the former DTL, the publication sections of two laboratories and such personnel as could be scraped together at Monmouth and elsewhere.

This agency faced a most difficult task. It started with a huge backlog of unwritten manuals and of written ones needing revision; the personnel were strange to each other and inclined to be suspicious; technical writers simply could not be hired in spite of the vacancies set up for them; many of the personnel had never done this type of work before. In addition, new standards of achievement were set by Washington. Two copies of the technical manual were to be packed with each equipment and each manual was to contain maintenance instructions and the list of replaceable spare parts, complete with stock numbers. The Army and the Signal Corps owe a debt of gratitude to the personnel of FMSCPA, which in six months cleared practically all of the backlog and put out fine manuals that were the maintenance man's best friend.

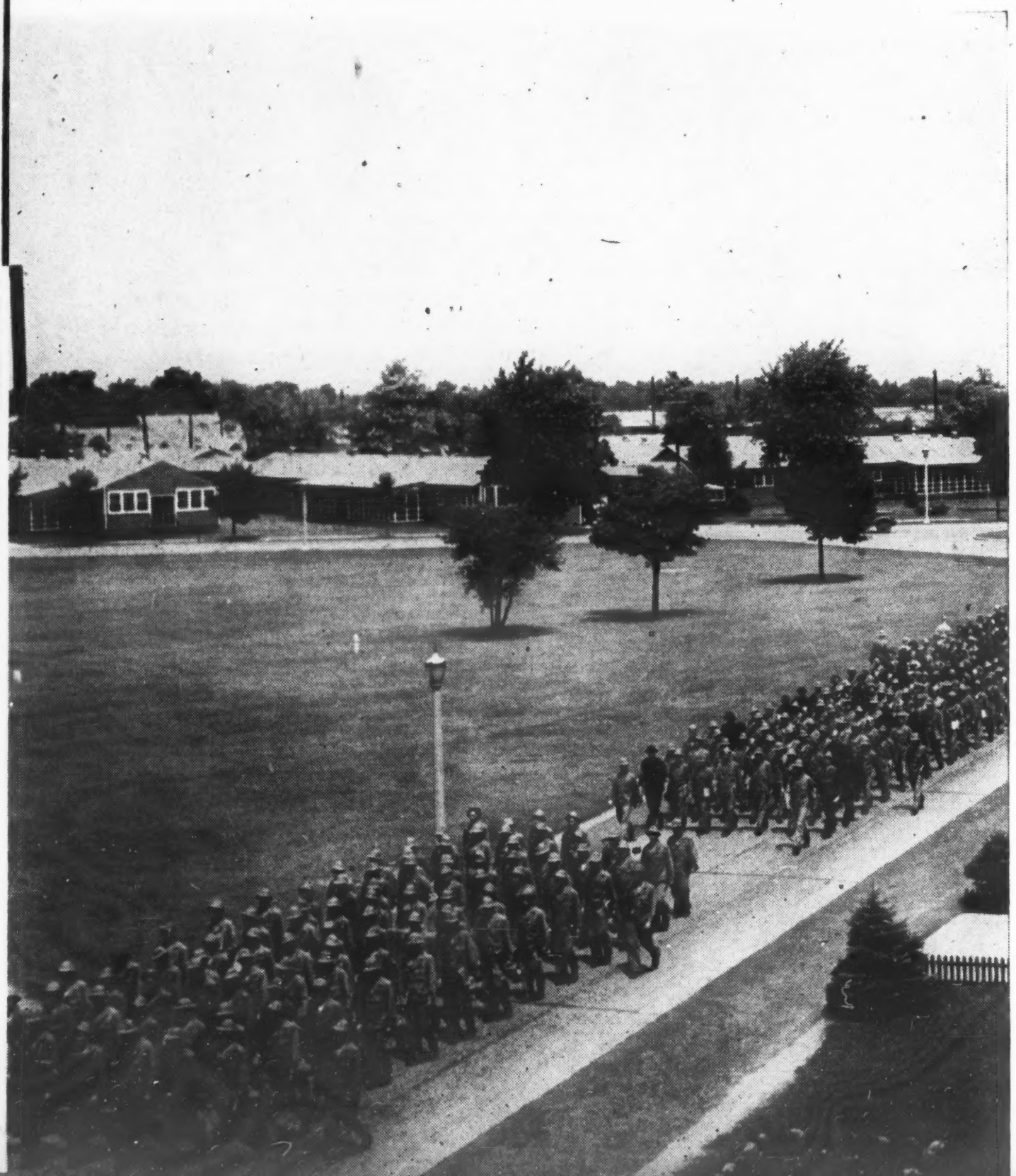
In 1944 the tempo decreased

but the training standards were raised. The OCS had an increase in the first six months because of a further need for officers but toward the end of the year the classes were small. The Enlisted Men's School was busy but not filled to capacity. As the school training load decreased it was decided to maintain Crowder as the only EMS. Radar and VHF training only were kept at Monmouth. Beginning with December no enlisted students other than for these specialties entered Monmouth. The Officers School also felt the decrease in input because of the smaller OCS output and it, too, became smaller. Meanwhile, the Post gained by the return of the Radar School. Camp Murphy had done its job and early in the year plans were made for transferring the school back to Monmouth. The move was begun in August. With these changes it was no longer necessary to use Camps Edison and Wood. These were placed on a temporary caretaker basis in early 1945. The UTC moved onto the main post.

Following V-E Day, Fort Monmouth began its work of redeployment training with little loss of time. During the week of 8 July 1945 detachments of the first redeployment units — b a t t l e-scarred Signal Corps veterans of Africa, Italy, France and German—arrived to be retrained for fighting in the Pacific. From July to 1 October 1945, the overall strength of the Unit Training Center increased from 4,218 to 9,196.

During the m o n t h s July, August, and September, 17 areas, including 159 buildings, were prepared for redeployed units. The Redeployment Branch prepared for 23 organizations having a T/O strength of 346 officers, 10 warrant officers, 6,528 enlisted men. Actually, only about 30 per cent arrived, because personnel eligible for discharge were separated by reception stations, and recuperation leaves and furloughs were extended 15 days.

OCS students marching to classes, 1942.



The redeployment training program had been carefully worked out. It covered a period of eight weeks and concerned itself with briefing the men about their new enemy "the Jap," about health and sanitation methods necessary for life in the Pacific Theater, and about the care of Signal equipment in tropic and jungle areas. A large part of the training program was devoted to orienting the men to the job still required of them and the reasons why they must do it.

In Retrospect

No brief article can tell the myriad accomplishments at Fort Monmouth during the war years. The magnificent achievement of the 15th in expanding from a company to a regiment of 5,000 men would have been incomparable had not the 803rd been fabricated out of thin air and invited comparison with itself. But that achievement is no more magnificent than that of every other activity of the post, which expanded from a total military strength of about 1,000 in pre World War II days to nearly 30,000 during the busiest days of the War.

Monmouth led the way in many things. For example, the schools were teaching carrier and repeater from the H-1 and the V-1 before the Army had issued any carrier or repeater equipment. Before the I & E instituted orientation as part of the soldier's training, Monmouth had decided that a man needed to know more about the Army, the Signal Corps and why he was fighting. The orientation course established locally cut failures from 25 per week to less than five. There were so many brilliant individual performances—the making of training aids, for example. No more satisfying work could be imagined than to supervise this training establishment and see every day a dozen evidences of the interest and skill that the men and women there were putting into their work. In this brief sketch I have deliberately mentioned no names. To single out anyone would be to slight a dozen others of equal merit. Each did his job in the task assigned and the results speak for themselves. I shall always be proud to have been associated with so fine a body of men. May our country always be as well served as it was by them!

EDITORIAL

Science and Modern War

The ASA convention at Fort Monmouth last month focused attention again on the important place of science in modern wars. To the average American the last war gave science a new meaning. Combined with engineering, it turned out the weapons with which the war was fought and won. Communications scientists and engineers made enviable contributions to the victory. This first global war of great speed and movement could never have been fought and won without radio for communications within and to the land, sea and air forces and developments in the related fields of radar, shoran and loran which contributed so much in the air warfare and the proximity fuse which gave all of our combat forces such a great advantage. And the release of atomic energy, the final and greatest of the wartime developments proved beyond any doubt that science had stepped into a more decisive part in man's affairs.

A National Insurance Policy

But America's leaders constantly emphasize that we must not assume that all past concepts of warfare can be ignored and that the war of tomorrow will be won by a few scientists alone.

If thoughtful and sincere Americans could pay a brief visit occasionally to Walter Reed Hospital and observe the lasting results of war to some of their young countrymen, it is certain that they would go away with renewed determination not to make again the mistakes of the 1920s and '30s which resulted in our country being pitifully weak militarily. They would be determined to insist that their representatives listen now to the advice of their military leaders—at least until United Nations is firmly established as the guarantor of peace. The most important legislation to be considered by the 80th Congress is that which would provide Universal Military Training. Such legislation has been urged repeatedly. General March, World War I Chief of Staff, recently told how he and other military chiefs had urged U. M. T. shortly after that war—only to be ignored, even ridiculed by the people and Congress. As late as early summer of 1940 when World War II had made a substantial start in Europe a suggestion was made in at least one War Department General Staff conference that the one action which might discourage the aggressors from attacking us was immediate presentation by the War Department to Congress of a plan for universal and compulsory service and the enactment of such legislation. It was too obvious that the people and Congress were not ready then to listen to such a proposal.

And now we have one more chance. It must accomplished this year for the farther we get from the terrible realities of World War II the less likely are the people to understand the need for positive action to keep us from a World War III.

Probably the most universally applauded appointment made by President Truman is that of George C. Marshall to be Secretary of State. And he has said again and again that we must have universal military training if we are to assume the responsibilities that go with our economic and technological leadership and power. And if we do not assume them there is no hope for the world.

It appears that the great majority of thinking Americans consider U. M. T. essential or at least desirable. The latest Gallup Poll shows that 72% of Americans favor it. Dr. Karl Compton, who is head of a committee of civilians studying the matter for the President, has said that there must be some degree of universal training to permit quick and effective mobilization if attacked.

Stalemate

Advocates of the President's Armed Forces Unification Bill have good reason to be concerned over the extremely slow progress being made at the Capitol in reporting out this bill which deserves action by this session of Congress. And these advocates include pretty nearly all the present day leaders of our nation—the President, the Secretary of State, the Secretary of War and Navy, the Chief of Naval Operations and the Chief of Staff, their planning advisers, Admiral Sherman and General Norstad, Mr. Charles E. Wilson, formerly of the WPB and now President of General Electric Co., and countless others. Army Ordnance Association in a recent bulletin discussed the bill in some detail and announced that its Executive Committee has recorded unanimous approval of the provisions of the new plan. But it is becoming increasingly plain that progress toward bringing the bill to the Congress for vote has been stopped in committee. Unless this stalemate is broken *now*, it could mean the death of this important defense plan as far as this session of Congress is concerned—and that might mean indefinitely, with a presidential election year coming on fast. The really dangerous thing about the delay is the near stoppage in this critical period in joint Army-Navy planning for National defense that has resulted. It is said that one reason for delay is the absence of letters from the people concerning the legislation, leading the committee members to feel that there is no apparent public interest in the bills. Congress must make some decision expeditiously.

As the editors of Army Ordnance put it in urging prompt action by the Congress—"Time is running out!" It's time for all the representatives of the people in the Congress to cast their votes for or against the bill.

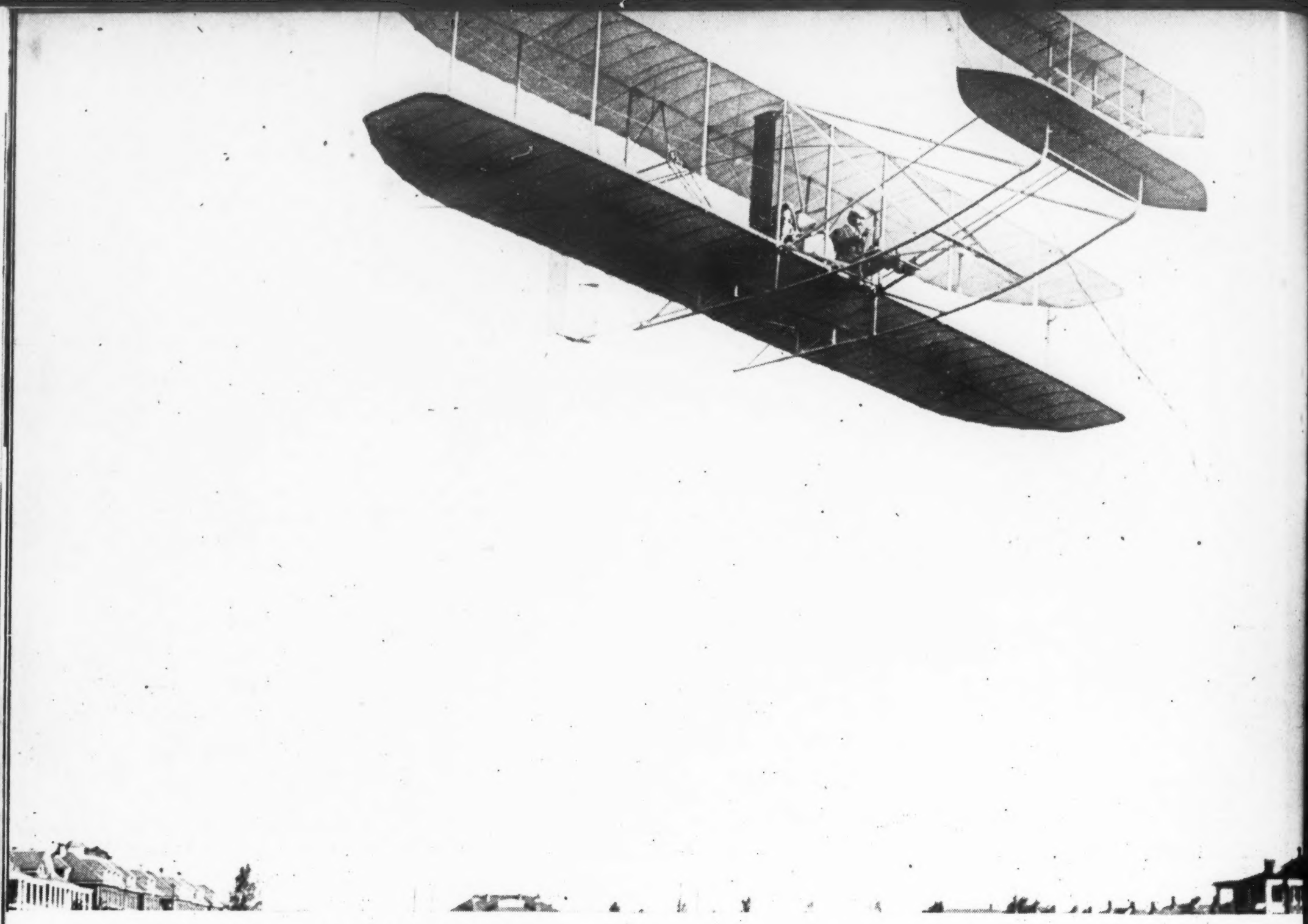
Photos

Even an 'atomic' army must rate the K.P. a key-man.

Duncan Hines, food connoisseur extraordinary, approves the UMT kitchens at Fort Knox, Ky.

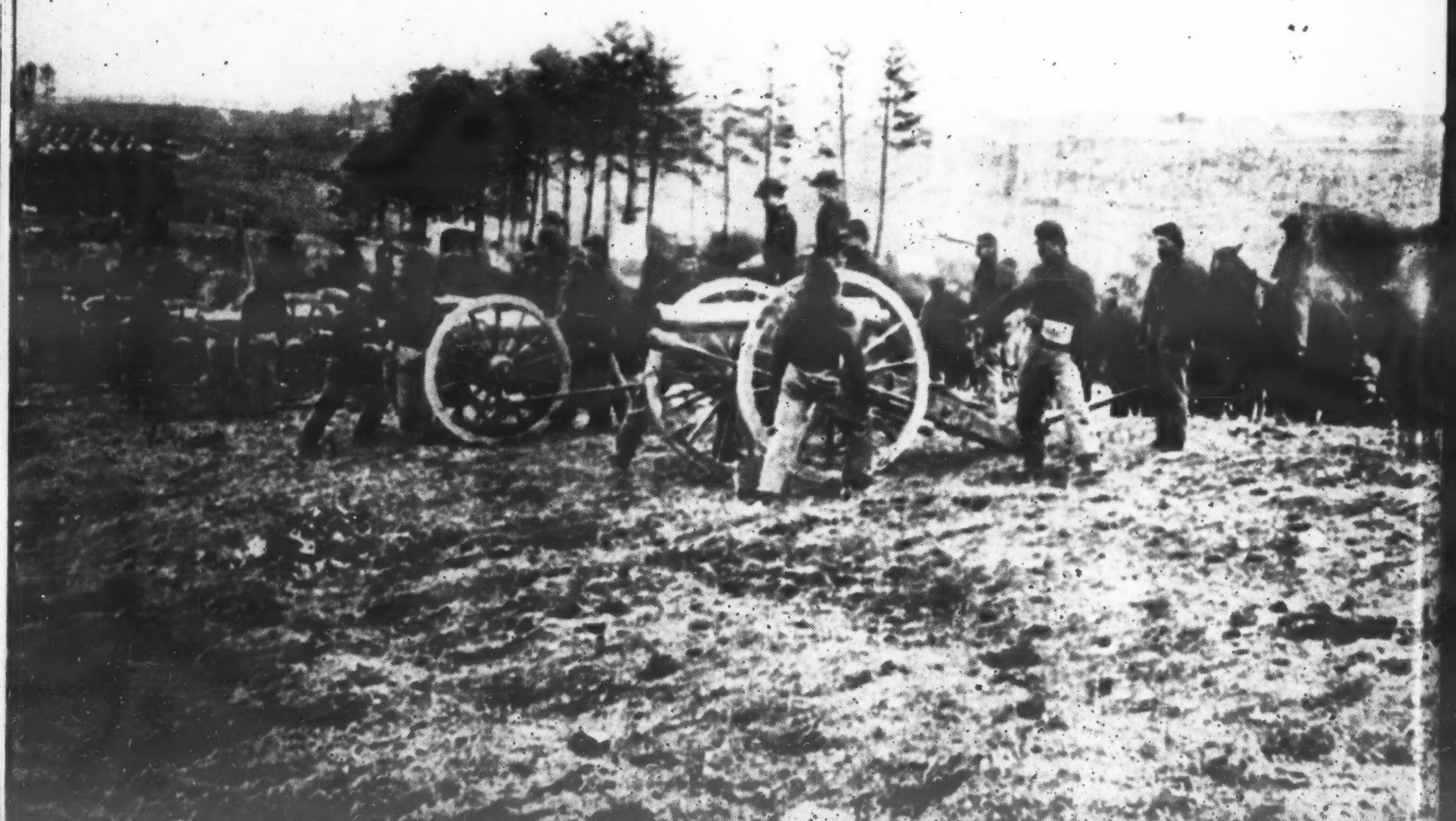
Shore fire-control directs Naval guns against Normandy coast. June 1944.

This equipment sends coded signal to remote and unattended weather station which then automatically transmits weather data.



Orville Wright pilots test plane at Ft. Myer, Va., 1909. Signal Corps procured first Army aircraft as result of these flights.

This photo of a Civil War Field Artillery battery in action at Fredericksburg, Va., is first actual picture of U. S. Army in combat. Taken by Matthew Brady.



Brig. Gen. C. T. Lanham, I & E Div., holds Academy "Oscar" awarded for Signal Corp's documentary, "Seeds of Destiny."

Major General Spencer B. Akin, new Chief Signal Officer of the Army, takes oath of office, administered by Brig. Gen. D. M. Fitch, Office of the Adjutant General.

CONVENTION REPORT

CLIMAXING the first full year of its existence, the Army Signal Association held its annual banquet and convention at New York and Fort Monmouth, New Jersey, on April 28-29. Members from all sections of the United States attended the meetings, indicating a lively interest in the Association and its objectives.

In May 1946 the then Chief Signal Officer, now retired, Major General Harry C. Ingles, activated Army Signal Association with the express purpose of establishing a liaison between the military and the communications industry. The initial year has been a period of organization and expansion, arduous and painful upon occasion, but productive of concrete results and a paid membership just under 7,000 as the second year begins. This youngest among the military-affiliated associations has passed its novitiate and looks forward to a long and useful function as a cohesive element in military communications and associated fields.

The Banquet

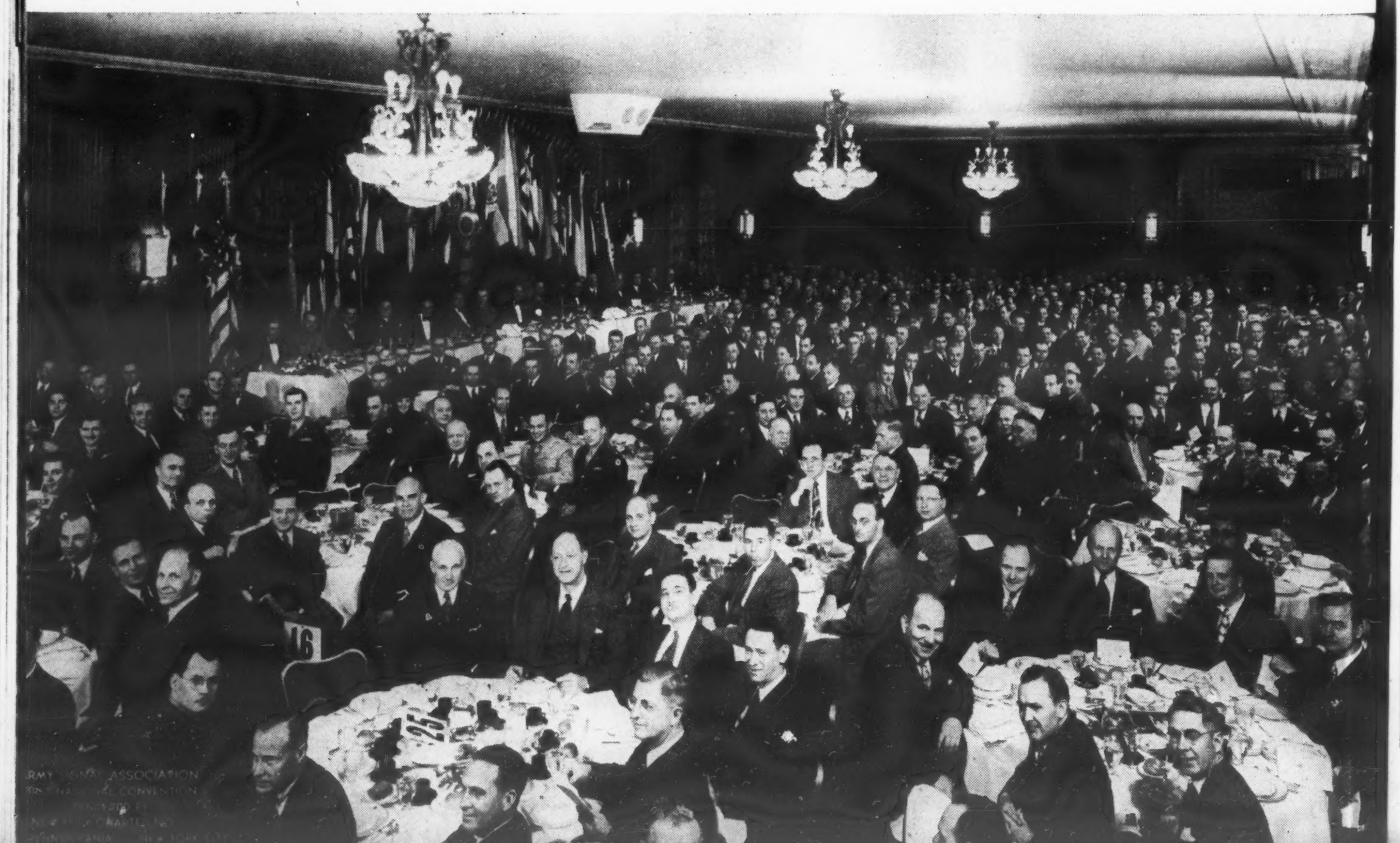
The New York Chapter, oldest unit within the Association, was the host in a pre-convention banquet, impressively staged in the sumptuous Georgian Room of New York's Pennsylvania Hotel. More than 450 members and their guests attended the dinner, which was preceded by a cocktail party in the Foyer. The banquet hall was completely filled and many late-comers were unable to gain admission.

The Georgian Room was beautifully decorated for the occasion. The speakers' table was set on a raised dais, above which the flags of the United Nations were mounted in a row that extended the length of the table. Dinner music was provided by a 6-piece string orchestra, with vocal accompaniment.

The dinner, served in the traditional Hotel Pennsylvania manner, consisted of fruit cup, potage Pennsylvania, celery, olives, roast turkey Chippolada, Potato Chateau, spring vegetables, mixed salad, Bombe Surprise, cakes and coffee, demi-tasse.

The after-dinner program began with the playing of the National Anthem and the call to order by Mr. D. R. G. Palmer, Chairman of the Dinner Committee and Toastmaster for the evening. He welcomed the members and guests of the Association and paid eloquent tribute to those signalmen who lost their lives in World War II.

Brigadier General Carroll O. Bickelhaupt, President of the New York Chapter, then extended an official greeting; spoke effectively of the purposes and achievements of the Association during its brief existence; finally, toasted the *corps d'elite* of our



Lt. Gen. J. L. Collins addresses the New York meeting

military establishment: the Regular Officers of the United States Army.

Mr. Palmer introduced Major General Spencer B. Akin, new Chief Signal Officer of the Army, who assured the members that the Association has the full support of the Signal Corps in the furtherance of its aims and objectives. General Akin stressed the need for the organization in the interests of the national defense.

Guests of honor for the evening were presented by Mr. Palmer. They were: Major General Spencer B. Akin, Chief Signal Officer of the Army; Brigadier General Francis L. Ankenbrandt, Air Communications Officer, AAF; Brigadier General Carroll O. Bickelhaupt, Vice President, American Telephone & Telegraph Co.; Lieutenant General J. Lawton Collins, Chief of Public Information, War Department; Major General (retired) Harry C. Ingles, former Chief Signal Officer; Colonel J. Harry LaBrum, Philadelphia Attorney; Major General Joseph O. Mauborgne, also former Chief Signal Officer; Brigadier General David Sarnoff, President, Radio Corporation of America; Brigadier General Stephen H. Sherrill, Executive Secretary, Army Signal Association; Rear Admiral Earl E. Stone, Chief of Naval Communications; Major General (retired) Frank E. Stoner, Chief of Telecommunications, United Nations Organization; Lieutenant General George E. Stratemeyer, Commanding General, Air Defense Command; and Brigadier General Samuel M. Thomas, Chief Engineer, R.C.A. Communications.

As the newly elected President of Army Signal Association, Brigadier General David Sarnoff spoke for the national organization. He read a letter from President Truman, dated April 3, 1947:

Dear General Sarnoff:

"It gives me much pleasure to greet the Army Signal Association on the occasion of its first convention, and to express my sincere hope for success in the significant mission which it has undertaken.

"This association's program for maintaining close relations between the Army and the communications, electronics, and photographic industries is an important contribution to the industrial preparedness which must buttress the future security of our country."

Very sincerely yours,
HARRY TRUMAN

General Sarnoff eulogized the Army career of General Ingles and presented him with a beautifully executed scroll, attesting to his Honorary Life Membership in the Association. "Dad" Ingles was given a rousing ovation that lasted for several minutes, brought the audience to its feet throughout the banquet hall. It was a fiitting testimonial to a brilliant soldier and a real humanitarian. General Ingles spoke briefly in appreciation and emphasized the urgent need for the perpetuation of the Association and the purposes for which it was conceived. The crucial test, he said, will be the renewal period just ahead, when it will be determined whether the membership will support the organization on a permanent basis.

Brig. Gen. Sarnoff presents life membership to Maj. Gen. Ingles

Principal speaker of the evening was Lieutenant General J. Lawton Collins, wartime commander of combat troops in the Southwest Pacific and in Europe, now Chief of Public Information for the War Department. In a

At New York.

Lieutenant General J. Lawton Collins:

"The dominant factor in war today is air power."

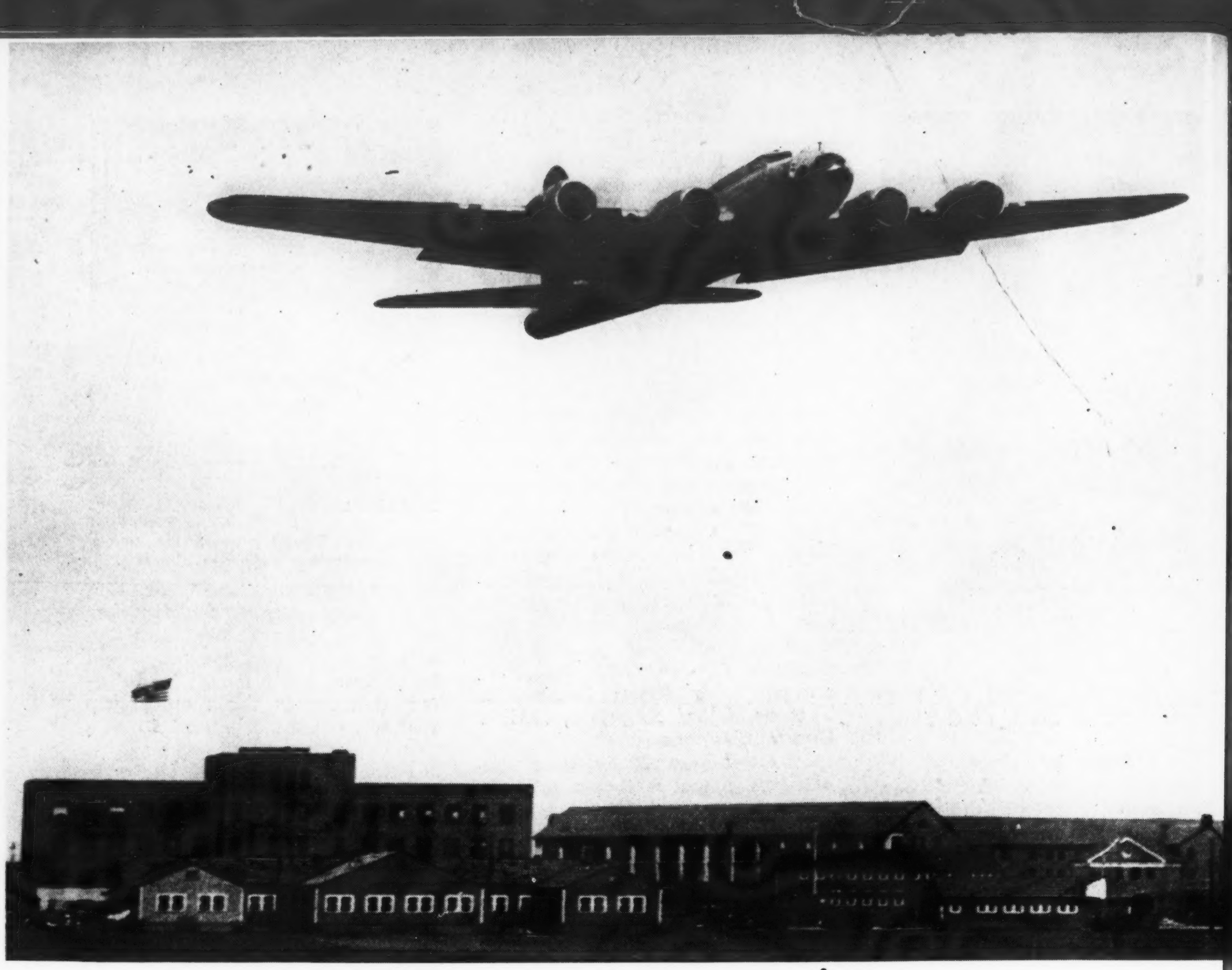
"Unity of command is an utter necessity. Authority and responsibility cannot be divided. The problem of national security must be considered a single entity."

"We must now look to the polar projections in considering future wars."

"Money spent on our armed forces is national insurance and will dignify our position in the United Nations . . ."

"We are out, not to win the next war, but to prevent it."

Two-day session at New York and Fort Monmouth brings first year to a close. Association, with difficult formative period behind, faces the future with renewed confidence of the support of military, industry and individual members in the integration of communications and photography within the structure of the national security.



B-17 bomber making GCA-controlled run over Parade Ground

firmly authoritative speech, General Collins outlined the prime lessons of World War II: the need for close integration between the military and our foreign policy; the establishment of a top intelligence service among all the Forces and in close liaison with civilians; the continued employment of science in promoting our national security; and, that future wars will not be fought solely by the armed services, necessitating the maintenance of plans for the most expeditious mobilization of our industrial resources.

General Collins stressed that neither scientists nor the military must determine our foreign policy alone. He said that, ". . . the War Department was delighted to give away control of the atom, if only because of the cost of the project."

The basic thought that he left with the audience was the desperate lack of time that would be available following the beginning of any future hostilities and that organizations such as Army Signal Association must assist the War Department in preparation for any conceivable emergency.

The First Annual Convention

Over 700 members of the Association gathered at Fort Monmouth on April 29 for the first annual convention and exhibition of signal equipment. The program extended throughout the entire day and set a high precedent for future meetings to follow.

Brigadier General S. H. Sherrill, Executive Secretary of the Association, called the meeting to order in War Department Theater No. 2 shortly after 10:30 A.M. He introduced Brigadier General Jerry V. Matejka, Commanding General of Fort Monmouth, who, despite a heavy cold, welcomed the visitors to the Post and its facilities.

Brigadier General David Sarnoff, the first elected President of Army Signal Association, then addressed the Convention. He outlined the first formative steps by General Ingles in 1946 and traced the growth of the organization during the first year. He paid tribute to the Executive Secretary and Editor, General Sherrill, and his staff, and expressed the confidence of the officers and membership in their work.

Major General Spencer B. Akin, the Chief Signal Officer, reiterated the support of his com-

> Major General Spencer B. Akin:
>
> "Fundamental to the defense plan is some means of relating and integrating our military plans with the scientific capabilities of our civilian economy."
>
> ". . . the success of our arms in World War II was, in great measure, due to the cooperation between all agencies of the government and also the economic, industrial, scientific and social agencies of our nation."

mand and acknowledged the lasting debt of the Armed Forces to those industrialists and scientists who "responded patriotically to every demand and consistently placed the war effort above every other consideration." He reviewed the importance of the Reserves and the National Guard in the defense of the nation and the great responsibility placed upon the civilian economy in over-all planning for the future.

The guest speaker of the day was Major General Sidney P. Spalding, Deputy Executive Chairman (Army) of the Army and Navy Munitions Board. He described the importance of planning for industrial mobilization as an "effective factor for preserving peace throughout the world." Mobilization plans have been drafted, General Spalding said, and are now in committee for approval.

Stockpiling of strategic materials has been provided for and will continue with an accelerated program in the future, he continued. Finally, a practical plan for rapid mobilization of industry must be prepared and accepted by the Congress, the President and the Public. There must be no repetition of the laxity in accepting the 1939 plan, which was not utilized when war began.

At Fort Monmouth, N. J.

Brigadier General David O. Sarnoff:

"The primary purpose of our Association . . . is the strengthening and safeguarding of our national security. We must do our utmost to help keep America prepared to meet aggression until the United Nations develops sufficient strength . . . to preserve peace and prevent war."

"Communications procedures and equipment must be reviewed and evaluated continually in light of rapid changes in military tactics . . ."

"A nation that is complacent and ignores the swift advances of science courts disaster."

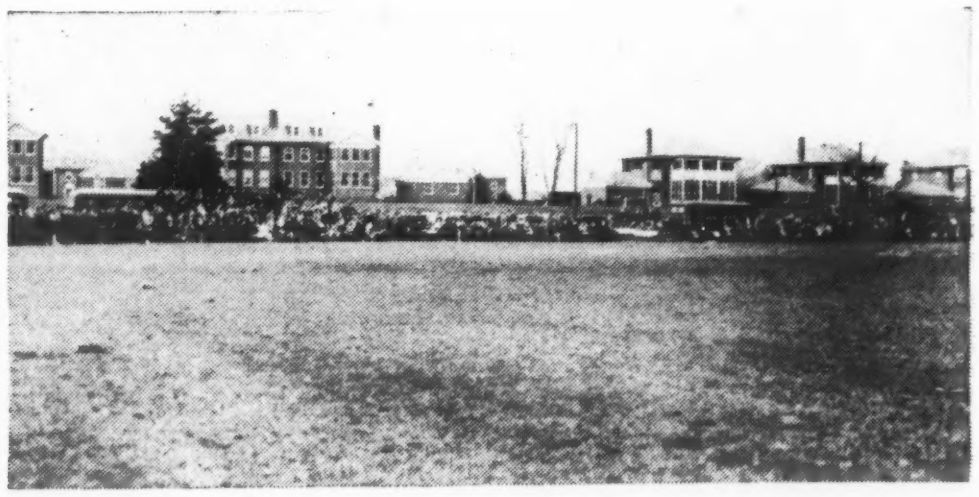
"Technology in wartime has proved that it possesses immense and dynamic power for good or for evil. A nation unprepared to combat newfound powers of science as unfolded in an Electronic and Atomic Age, is in grave danger."

In concluding the Convention business meeting, General Sherrill read excerpts from the first annual report of the Board of Army Signal Association. He announced the adoption of the new permanent constitution through letter balloting conducted during the past two months and read results of the election of officers and directors. The report and list are printed elsewhere in this issue of SIGNALS.

The Exhibition

Following luncheon in the Service Club, the exhibition and demonstration of communications and photographic equipment and materiel was staged in the tent area immediately in front of Squier Laboratory. Participants were: The Signal Corps Engineering Laboratories; Watson Laboratories, Air Materiel Command; Signal Corps Photographic Laboratories, Astoria, Long Island, N. Y.; Signal Corps Schools; and, the Army-Navy Electronics Standards Agency. The Fort Monmouth commandant, General Matejka, and his staff, did an excellent job in providing the facilities and coordinating all the complex details accompanying such a show. Particular credit is due Lt. Col. W. D. Joslin and Mr. J. Kravetz, who coordinated for SCEL.

Reviewing the parade: Brig. Gen. J. V. Matejka, in front; 1st Lt. James Thornley, aide, directly behind; rear, left to right—Col. E. F. Hammond, Col. C. B. Brown, Col. P. L. Neal, Col. D. H. Nelson



ASA members await parade on April 29th

Tents for ASA Exhibition being erected

Mr. Julius Kravetz of SCEL, Lt. Col. W. D. Joslin and Lt. Col. R. A. Gaw prepared and coordinated the ASA Exhibition

It was a sparkling day—band music welcomed the visitors upon their arrival at the Control Center—old friends met again after months or years of separation and re-lived wartime experiences in the United States or overseas. A holiday spirit prevailed. Army Signal officers from AGF Headquarters and the six Army Headquarters in the United States were present for a special conference which followed the exhibition. United States and foreign officers from the schools at Fort Leavenworth and from West Point were present to view the demonstrations. Large tents were erected in the area and equipment was displayed in the 'county-fair' style, with technically qualified personnel available to answer questions and explain the functions of each item.

Electronics and photography, mobilized for war, were presented to members and guests of the Association in an exhibition that pointed-up the acute awareness of the War Department to the technological nature of Twentieth Century warfare. No field of communications was neglected: teletypewriter, facsimile, radio, wire, television, radio-relay, micro-wave equipment, public address, earth borers, supersonic obstacle detectors, Geiger counters, Optiphone, thermo-detectors, meteorological equipment, barrage jammers, radio-direction-finders, radiosonde, automatic weather stations, batteries, radar units, winterization gear, climate test chambers, power units, switchboards, telephones, captured enemy equipment, training films, documentaries, film strips, identification photography, portable darkrooms. The visitor at Monmouth on April 29 knew that our armed forces are abreast of the field in electronics, communications and photography.

Watson Laboratories, Eatontown, New Jersey installation of the Air Materiel Command, AAF, staged a major demonstration of Ground Control Approach on the Parade Ground. A Boeing B-17 heavy bomber was used and it was brought in, blind, over the GCA unit time after time in a graphic display of the effectiveness of radar in the control of aircraft.

A five-way radio-teletype conference was held in Theater No. 2. The tape was projected on a slanting screen and the audience was able to follow the progress of the conference in its entirety. The conference between Signal Officers of both Ground and Air Forces assembled at Headquarters in Tokyo, Frankfurt, Hawaii and San Francisco proved an effective way to emphasize the importance and the efficiency of present day communications. The names of those assembled at each Headquarters were flashed in 6-inch letters on the screen. Messages were sent by General Sarnoff and General Akin to each distant point and replies were received from General Back in Tokyo, General Lanahan in Frankfurt, and Colonel Miller at Fort Shafter, Hawaii.

The afternoon was terminated by a retreat ceremony and parade by troops stationed at Fort Monmouth, after which buses were ready to take visitors to Little Silver and Trenton.

With the first year now past, your Association has the assurance that it will receive the active support of those segments of the military and industrial establishments in whose hands lie the ultimate fate of the nation.

There shall be no relaxing in the continuing effort to maintain an alertness in the public consciousness to the terrible danger inherent in unpreparedness. Only thus can the Army Signal Association justify its existence. Only thus can we, as an autonomous nation, hope to preserve that political and economic freedom for which we have now fought two major wars.

Major General Sidney P. Spaulding:

"The knowledge that the tremendous industrial power of the United States can be quickly and effectively mobilized . . . is one of the most effective factors for preserving peace throughout the world."

"There is no substitute for our Army, our Navy, and our Air Forces. But, in turn, our armed forces are dependent upon our industry for their armaments and for their very existence."

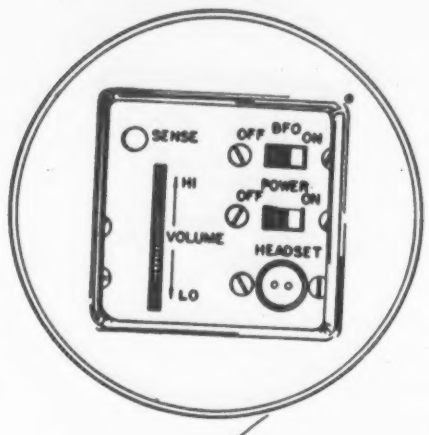
"In brief, industrial mobilization means the changing over of the economy of the nation so that our resources may be directed into war channels."

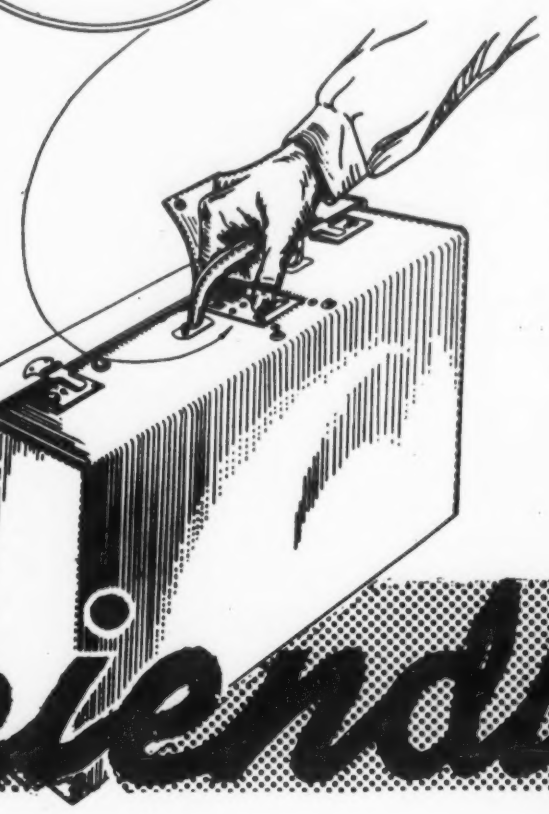
"A thorough and comprehensive plan for . . . industrial mobilization constitutes an element of national strength which will be respected by aggressive nations just as a standing combat force is respected."

"A vigorous civilian economy backing up industry and the military is as vital as the military itself. Not only must there be jet propelled planes and rocket ships, but equally as important are shoes for the farmer and automobiles for the factory worker."

". . . the service associations . . . will always be needed to support the principle of planning for industrial mobilization. They can be a source of great strength and encouragement."

"Our planning does not reflect any belief that a future war is inevitable. This industrial mobilization plan merely represents prudent preparation as insurance for national security. It might be the controlling factor that will preserve the peace for us and for the world."





Radio direction-finding equipment was the basic component in some of the war's most hazardous projects

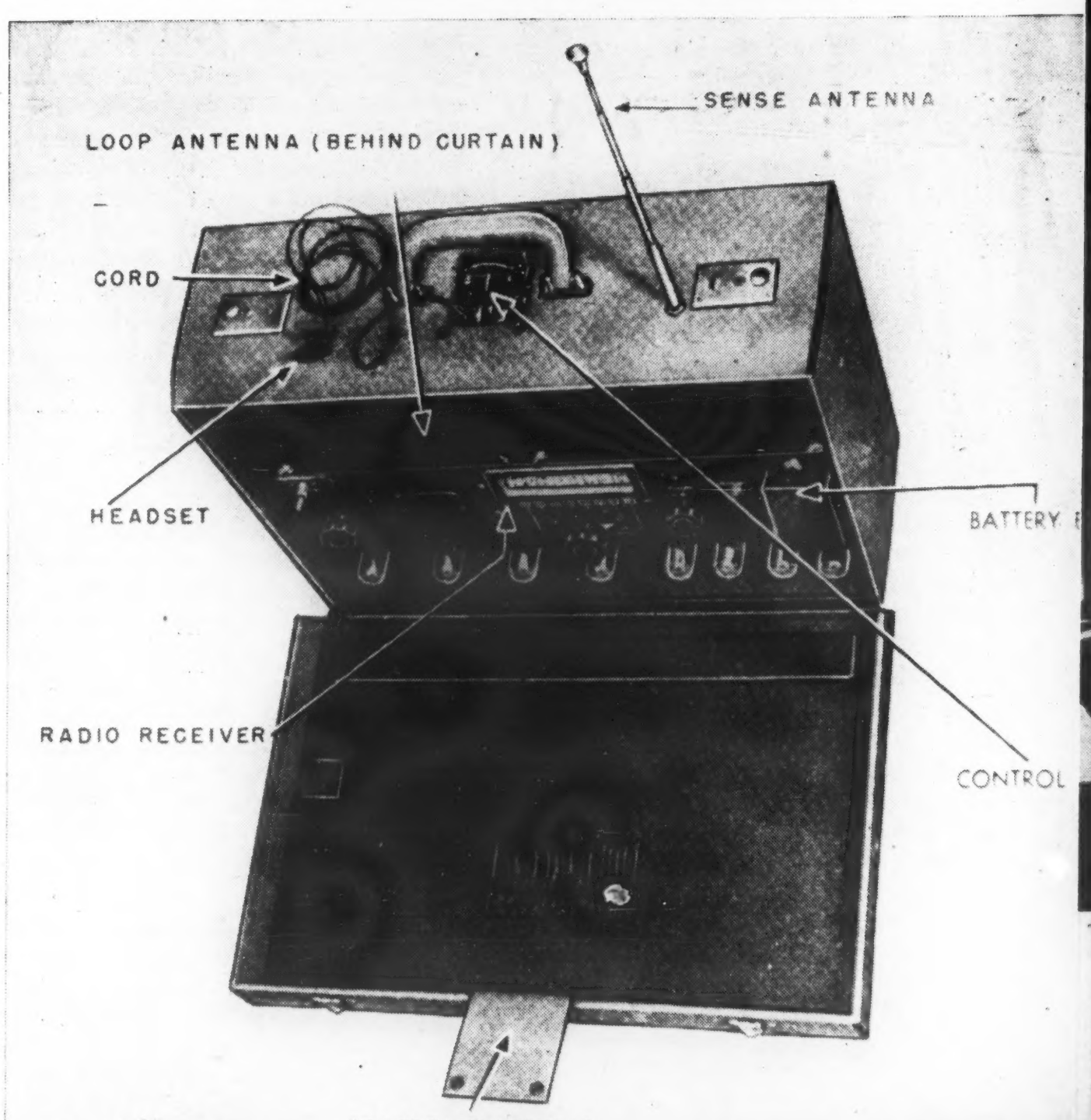
Friendly Agent

By Darvey W. Wixon
Signal Corps Engineering Laboratories

SOMEWHERE IN German-occupied Europe, during World War II, an Allied intelligence agent unobtrusively made his way through the crowded streets of a large city. There was nothing to distinguish him from the other pedestrians except that he seemed to be deaf, for he wore a tiny hearing-aid plug in one ear, with the wire disappearing beneath his collar. He carefully carried a very ordinary suitcase at his side.

If there had been reason for suspicion, close observation would have revealed something singularly strange about his actions and the bag. A wire, cleverly concealed, ran from beneath the handle of the suitcase to the sleeve of his coat, suggesting some connection with the lead from the ear plug. He fumbled occasionally with a flap beneath the handle of the case and seemed uncertain of his course, turning corners and then retracing his steps in the original direction.

Had he been apprehended by the Nazis, the suitcase would have revealed a portable radio direction finder. For, nicely enclosed within the case, was an 8-tube radio receiver with a directional antenna system designed for tracing the location of enemy



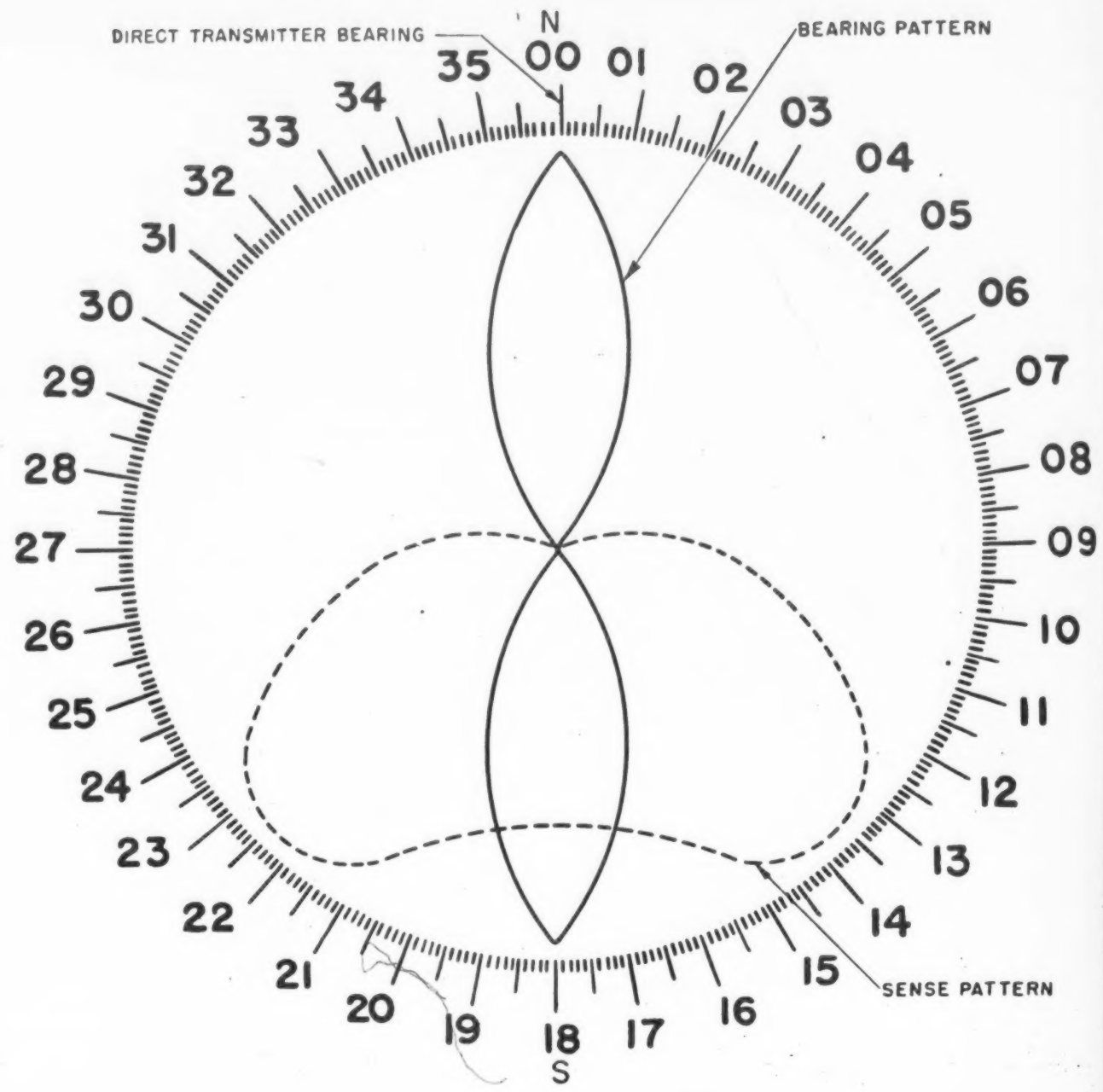
radio transmitters. The flap below the handle of the suitcase covered the control panel, from which a wire led to the hearing-aid type headset. After taking a bearing with a collapsible rod antenna to determine the general direction of a transmitter, the operative had thereafter been able to "direction find" in the best "cloak-and-dagger" manner by merely following the direction of strongest signal received by the loop antenna in the suitcase.

Snooper

This "snooper set," known in the Army as the SCR-504, was but one of many direction finders developed during the war by the Signal Corps Engineering Laboratories, in conjunction with several industrial organizations. Other more sensitive and accurate sets were used in a wide range of military applications. Though not as spectacularly publicized as radar, its more glamorous radio relative, RDF (radio direction finding) played equally as important a role in the war.

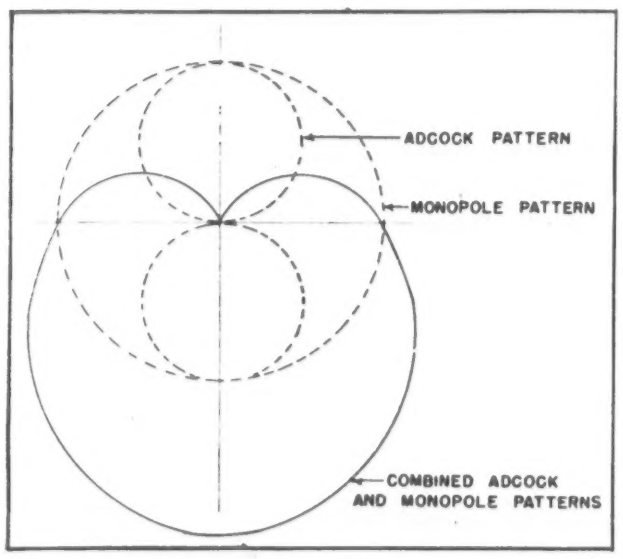
RDF was most widely used as a navigational aid for aircraft, functioning as a sort of "seeing eye" to provide accurate geographic positions or "fixes" for planes in flight, and to "home" them onto landing fields.

As a position-fixing device for aircraft, direction finders were set-up in networks along air routes by the Army Airways Communication Service. With five or six satellite stations established at strategic points and a central control station operating as a plotting and communication headquarters, the network was able to provide fixes in response to requests from pilots for navigational aid. The direction finders were placed from 100 to 600 miles apart and covered an area along air routes of from 1,000 to

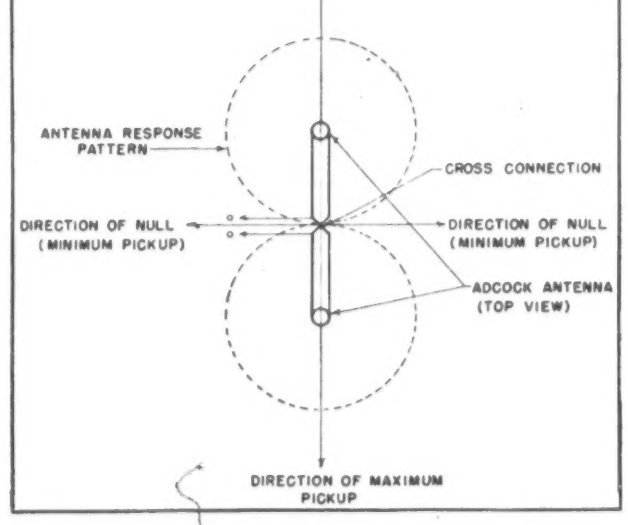


Bearing and sense patterns as they appear on RDF 'scope. Patterns appear alternately as SENSE switch is pressed on and off. The sense pattern simulates the tail of an arrow pointing toward transmitter bearing 0° or North here.

1,500 miles in diameter. Whenever a station received a request for a bearing, it alerted the network. Signals from the plane were then intercepted by the other stations, and the bearing of the plane in relation to each direction finder in the network was relayed to the central control station. After bearings from all the satellite stations had been plotted at the control station on a map and the geographic position of the plane determined by intersection of the lines of direction, the fix was reported to the plane—the entire procedure requiring but a few minutes.



Combined Adcock and monopole antenna polar response diagram.



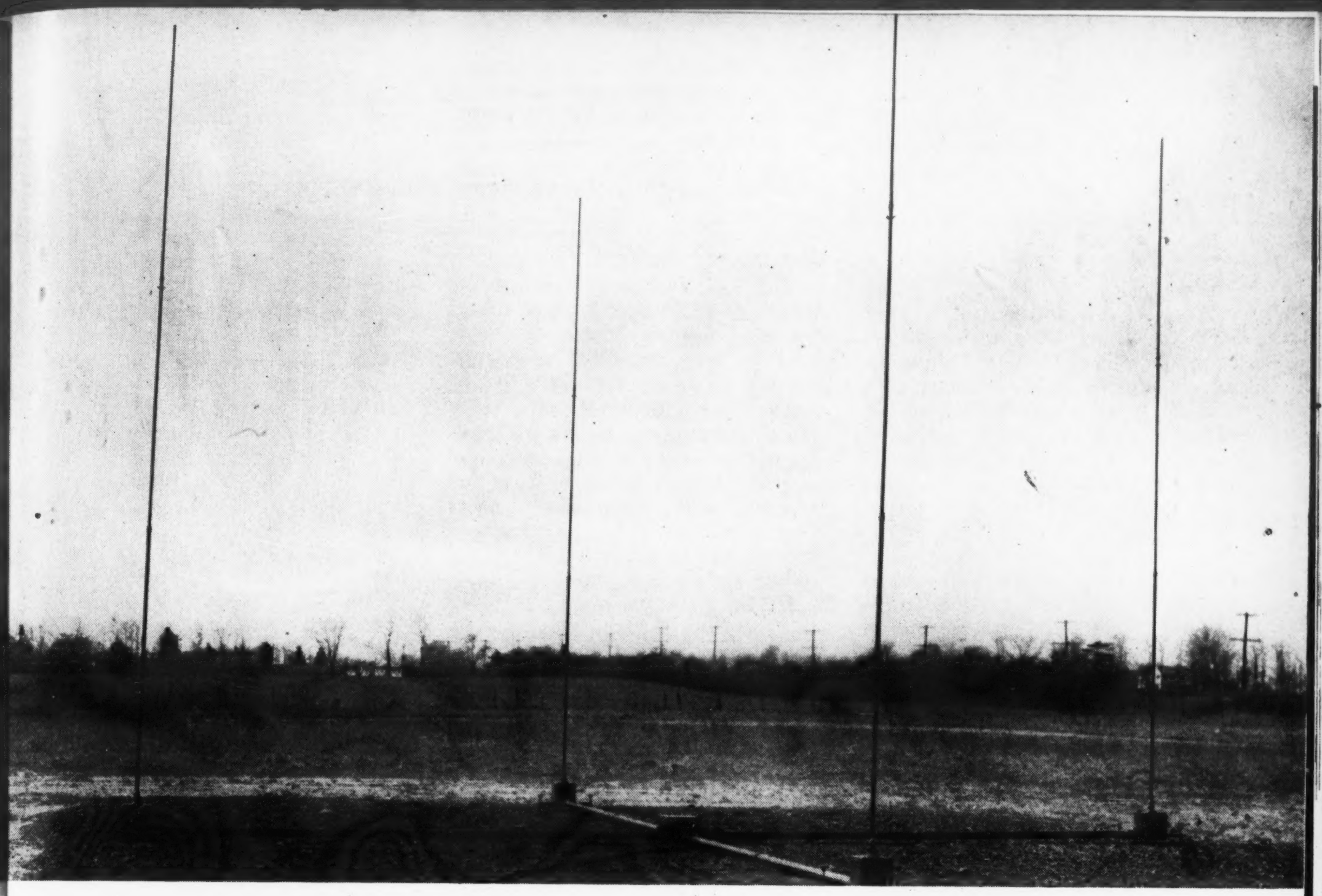
Adcock antenna polar response diagram, showing directional properties.

Such was the global coverage of this RDF service that an Army pilot flying almost anywhere in the world could expect a prompt reply to his request for a fix. In the North Atlantic run alone, thousands of planes made safe crossings because of the navigational aid afforded by RDF, and many flyers downed at sea were rescued by the same means.

Homing

As a "homing" device for guiding planes on to landing fields, direction finders are employed in much the same manner, except that only one equipment is necessary, either in the plane or at the landing field. The technique is simply that of sending a request for a call signal, fixing it to determine the position of the plane with respect to the landing field, or the converse, and making the necessary course changes to complete a landing on the indicated bearing.

At front lines, direction finders were used for general tactical radio intelligence and countermeasure activities. Three or more RDF sets would be placed some distance apart to form a network similar to that described above.



Antenna system of AN/CRD-2. This stationary crossed U-Adcock array is completely electronic in operation and requires no auxiliary sense antenna.

Tuning in to radio transmitters in enemy tanks and vehicles, the network would relay bearings to a control station, enabling intelligence headquarters to trace the movements of enemy columns relative to the front. Artillery counterfire could be directed in the same manner. Enemy or fifth-column personnel directing artillery fire by radio behind Allied lines could be ferreted out by direction finders, which could also be used to locate lost radio-equipped vehicles or troops.

Countermeasure

As a radar countermeasure, RDF helped to set the stage for the invasions of Normandy and Southern France. For months prior to the invasions, direction finders operating from England and Corsica scanned every mile of the European coast opposite the two islands, taking bearings on German radar transmitters, which in turn were searching the seaward approaches on the lookout for the expected assaults. By this means, rather complete information was obtained concerning German coastal radar operations: the exact location of installations, the type of equipment used, the frequencies, the operating schedules, and even the pulse repetition rate employed. Before the invasion fleets embarked, bombing missions were sent out to destroy the radar installations. Those not attacked were effectively "jammed" by transmitters operating on the same frequency or by the dropping of "window," strips of metal foil which reflected radio waves and caused spurious echoes in radar receivers.

Thus, blinded at a critical moment by the loss of his radar "eyes," the enemy was unable to follow the invasion fleet and organize strong resistance against the initial landings. The Allies saved thousands of casualties and insured themselves against the possibility of a catastrophe in an operation otherwise attempted under the full scrutiny of unopposed enemy radar.

The Atlantic

In the Battle of the Atlantic, the warfare against German submarines was similarly aided by RDF. Patrol planes equipped with direction finders prowled the sea, listening ceaselessly for radio and radar signals in order to plot the location of U-boats. So effective was this constant radio vigilance that enemy submarines, deprived of the use of radar for detecting their prey, lost much of their effectiveness against Allied shipping.

A wartime use of RDF that is finding extensive peacetime application in weather forecasting is the employment of direction finders, in conjunction with radiosondes, to determine the velocity and direction of high-altitude winds. In this use, a special RDF set, the SCR-658, tracks the ascent into the stratosphere of a free balloon carrying a radiosonde, a small transmitter equipped with meteorological instruments which transmits data on humidity, temperature, and pressure in the from of radio signals. A highly directional antenna, turned manually by an operator, follows the course of the balloon transmitter, being kept on target by matching the pips of the signal trace on the screen of an oscilloscope. Elevation and azimuth (direction) angle readings, the basic data furnished by the direction finder, are made at one-minute intervals.

With this information, plus atmospheric pressure readings indicating altitude at any moment during flight, the direction and velocity of winds aloft can be determined by trigonometric calculation.

Sferics

Another meteorological use of RDF is *Sferics,* the long-range direction finding technique by which storms are detected and plotted over areas thousands of miles in extent. The principle is the same as that used in position-fixing of planes, except that, instead of using standard direction finders to trace the source of radio signals from a transmitter, static direction finders are used to locate the source of discharges of static electricity originating in thunderstorms, cloud masses, or rainfall. Bearings taken at several stations in a widely spaced network are plotted on a map by means of triangulation to determine the location of the storm center. By this method, storms can be tracked over ocean or polar areas where it would be difficult, if not impossible, to establish weather stations. During the war, a Sferics network was set up on the Atlantic Coast, with stations in Florida, Bermuda, New Jersey, and Newfoundland. Additional networks now cover the Caribbean Sea and the Western Pacific.

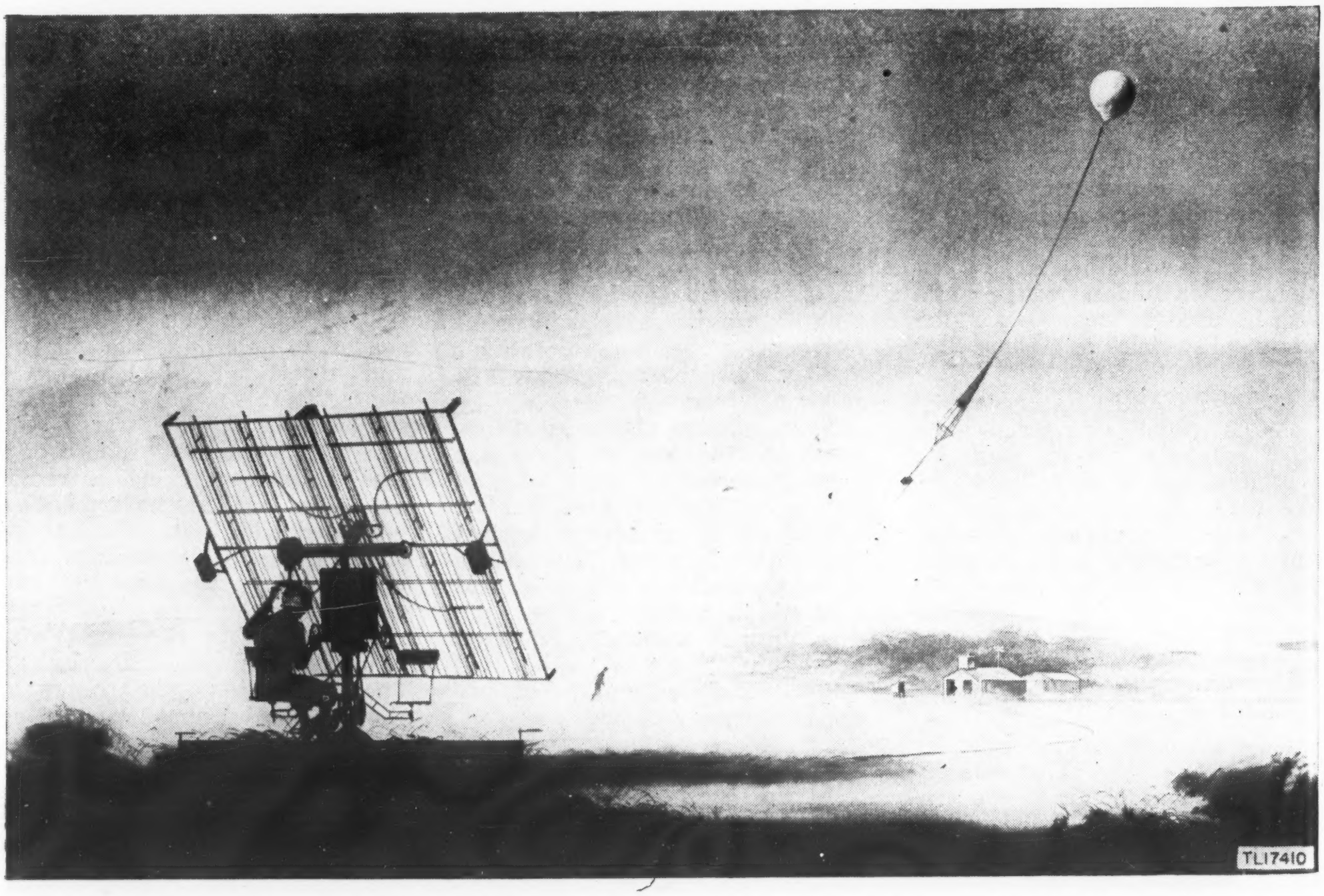
The Fundamentals

The basic principle underlying all these RDF applications is relatively simple. Radio direction finding is a method of determining the direction of a transmitter (or source of static electrical discharges, as in Sferics) by means of a radio receiver and directional antenna. A direction finder consists essentially of these two components, plus a means of indicating the direction of arrival of the received signal.

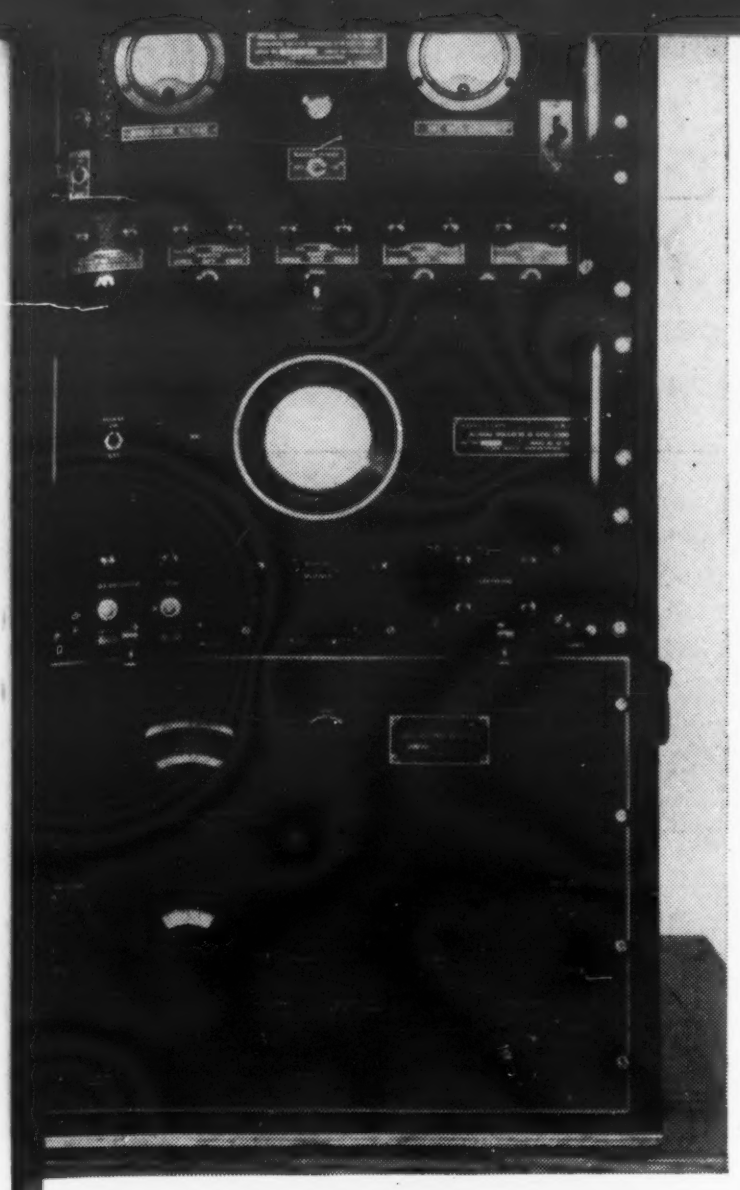
In all radio receiving sets the interception of radio waves is accomplished by an antenna. If it is the non-directional type, a single vertical wire or monopole aerial, the direction of arrival of the radio signal cannot be determined, for reception will be equally strong from all directions. If, on the other hand, two vertical monopoles are erected some distance apart and connected together in phase opposition, a directional antenna is obtained which responds with varying output, depending upon the position of the antenna array relative to the direction of arrival of the radio wave.

When this Adcock antenna, as it is known, is turned so that the wo monopoles are in line with the direction of the transmitter, the incoming radio wave arrives at the nearer monopole a split second before reaching the farther monopole. The difference in time amounts to an incredibly minute fraction of a second, considering that radio waves travel with the speed of light (186,000 miles per second), but is sufficient to produce a difference in phase between the voltages induced in the two monopoles. This time lag obviously is greatest when the monopoles are in the line of travel of the radio wave and decreases to zero when the antenna array is broadside to the direction of wave arrival.

Since the voltage output of the antenna varies in direct ratio to phase difference, it can readily be seen that by rotating the array to obtain a signal "null" (minimum or zero response occurring when the antenna is at right angles to the direction of arrival



SCR-658 in operation with balloon-borne radiosonde. Velocity and direction of winds are determined by tracking course of small transmitter suspended from balloon.



Operating rack of AN/CRD-2, showing modulating voltage generator, bearing indicator and radio receiver.

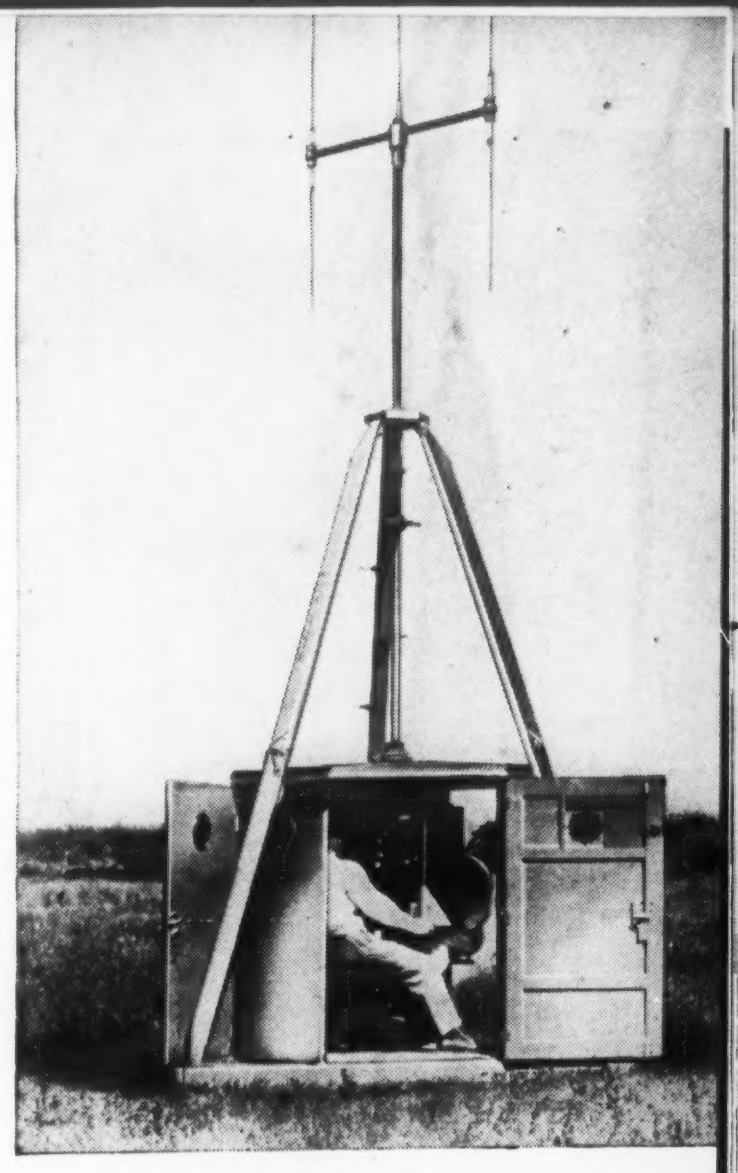
of the radio wave) the direction of the transmitter can be ascertained from the position of the antenna. Actually, only a reference line is established, indicating the line of arrival of the signal. The problem is to determine which of the two opposite directions along this reference line is the true bearing of the source of the signal.

In sets other than the AN/CRD-2, a late model direction finder embodying several revolutionary improvements in direction finder design, it is necessary to resolve this 180° ambiguity in bearing indication by using an auxiliary antenna. By switching in a single monopole aerial whose phased output, when combined with that of the Adcock antenna, produces a new directional characteristic, it is possible to determine the true bearing of the transmitter in the manner described below. In other words, the Adcock antenna indicates to the operator that he is "on the beam"; the auxiliary or "sense" antenna tells him whether he is "coming or going."

Directional antenna systems may be rotary or stationary, depending upon application. Where physical size makes a rotating antenna impractical, a stationary system is used, consisting of two Adcock arrays set at right angles to each other with a sense antenna placed at the intersections of the diagonals. The rotary or "direction finding" effect of a revolving antenna is accomplished in this stationary system by a goniometer or rotating transformer, a combination of two stators set at right angles to each other and connected individually to their corresponding Adcock antennas, and a rotor turned by motor and connected to the receiver and indicator of the set.

The voltage output of the antenna is detected and amplified by the receiver and indicated either aurally, as in the SCR-504, or visually on the screen of a cathode-ray tube. In the latter type, the response characteristics of the antenna, when the receiver is properly tuned to a signal within the frequency range of the set, are continuously plotted in a propeller-shaped pattern on a circular screen bearing 360° azimuth markings, calibrated in 1° intervals. The tips of this propeller-shaped pattern indicate the bearing, in the true and 180° opposite direction, of the transmitter. The operator determines which end of the pattern indicates true transmitter bearing by pressing a switch, which connects the sense antenna into the antenna system and causes a cardioid or heart-shaped pattern to appear on the screen at one end and in place of the bearing pattern. The composite pattern thus visualized by the operator in switching the bearing and sense patterns on and off resembles an arrow with the point toward the true bearing and the tail toward the reciprocal bearing. The direction of the incoming wave may then be ascertained, within an accuracy of 1°, simply by reading the azimuth marking on the screen opposite the correct end of the bearing pattern.

As indicated above, certain radical improvements in direction finding design have been made. The AN/CRD-2, an air-transportable set developed by the Signal Corps Engineering Laboratories, incorporates several features which make it far superior to all other radio direction finders in respect to sensitivity, accuracy, speed of indication, and frequency coverage. These include an entirely electronic method of operation, elimination of an auxiliary sense antenna, and electronic orientation of the antenna system from the operating rack.



Rotary antenna type radio direction finder SCR-556, with operating hut for field installation.

Designed to take bearings on short- or long-range signals transmitted either from ground stations or aircraft in the frequency range of 0.54 to 30 megacycles, the AN/CRD-2 consists of a stationary antenna system of four vertical aerials arranged as crossed Adcocks and a compact operating rack, consisting of an ordinary communications receiver, an electronic bearing indicator, and a control unit. The antenna array is, in effect, rotated approximately 9,000 revolutions per minute by an "electronic goniometer," a system of electronic circuits in the operating rack and antenna system. In obtaining a sense voltage without resorting to a sense antenna, a voltage is taken from each of the four aerials and shifted 90° in phase. The voltages thus obtained are then amplified and connected together, the resultant voltage forming the sense pattern on the screen of the cathode-ray tube. Electronic orientation of the antenna system is accomplished by a special variable phase shifter which shifts the angular relationship of the indicator with respect to the antenna system, thus providing, in effect, the same results as would obtain by revolving the antenna.

Rocket exploration of the stratosphere at White Sands is opening a new super-terrestrial chapter to science

Into the

By Harold Berman

Signal Corps Engineering Laboratories

CAN A ROCKET or a space ship be shot to the moon? Can we neutralize the gravitational force of the earth with self-propelled missiles?

Perhaps; but before inter-stellar space can be reached the ionosphere must first be traversed. Experiments at the White Sands Proving Grounds in New Mexico have demonstrated that penetration of these regions is now feasible. The tests in the desert have also made it clear that human cargo will have to be protected against physical conditions pertaining in the ionosphere and beyond.

The rocket and guided missile program, under the direction of the AAF, in which the Signal Corps is a major participant, has many interesting tangents leading into pure research concerning the ionosphere.

The Ionosphere

Also known as the Kennely-Heaviside layer, the ionosphere is a region of ionized and other radio reflecting strata without which long distance transmission and reception at high frequencies would be quite impossible. A series of these electrified layers envelope the earth at heights varying from about 25 to 250 miles. To better understand this envelope it should be remembered that great variations may occur within it.

The layers change from daylight to darkness; they vary at

Ionosphere

different seasons of the year; and they are not identical in all sections of the earth. During daylight the ionosphere begins at the "C" region, at a height of about 25 miles.* Just above is the "D" layer, beginning at 35 miles and rising to 50 miles. Separated by a 10-mile interval, the "E" layer extends to some 90 miles above the earth. At 100 miles are found the last two *known* layers, the "F" regions: the "F-1" and the "F-2," at 250 or more miles above the earth.

But after sunset, conditions change. The D and E regions disappear and the two F layers merge at the height of the F-2. Each of these strata, night and day, has specific electrical characteristics and density and will affect electro-magnetic propagation in a manner peculiar to itself. That is one reason why different frequencies are chosen for particular types of communication.

Radio waves at high frequencies travel in straight lines like light beams. If they were not reflected by the ionosphere they would not follow the earth's curvature as they do, but would shoot off the horizon into space. Radio frequencies are chosen to best reflect from a most suitable ionospheric layer back to the earth's surface, where they rebound back to the reflecting layer, completing the cycle continuously en route to the receiving station. This skipping

"sky wave" is sometimes named according to the number of hops and the layer used for reflection: "two hop E's," or a "four hop F." Since transmitting antennas radiate at all angles, an infinite number of sky waves are constantly in motion, reaching the destination with a varying number of hops, dependent upon the angle of radiation. Although only microseconds are involved, there is enough time for phase shifts and under certain conditions the staggered waves will cancel out at the receiver. This phenomenon is the "selective fading" common in short wave reception.

Meteorology

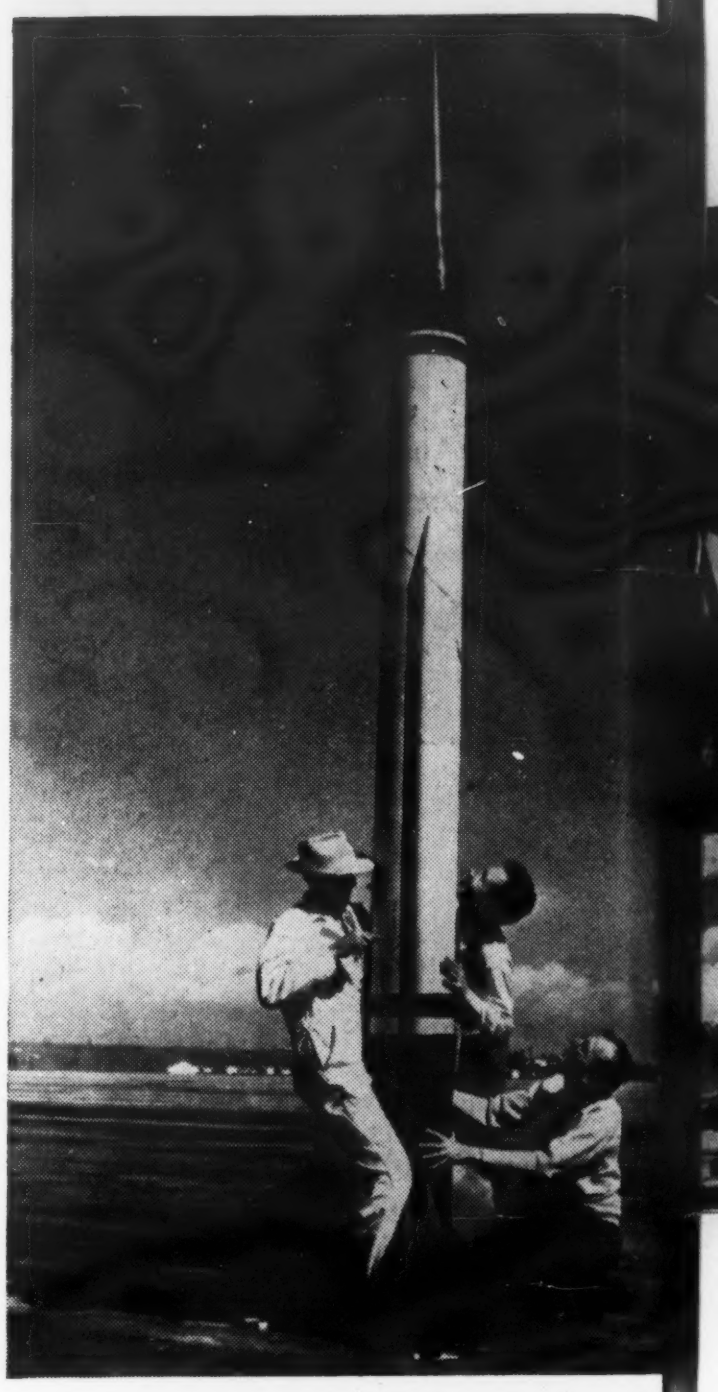
Many factors affect the character and reliability of radio reception. The useful science of meteorology strives to define these changing conditions in order to furnish one of the most important links in the maintenance of radio communications. To this end, the modern meteorologist seeks to detect in the air and in layers surrounding our planet new effects or variables heretofore unknown that will go far beyond the past knowledge of these regions.

At White Sands meteorology will be served by instrument-carrying rockets like the "WAC Corporal," which is shot into the lower ionosphere and will transmit information about the temperature, pressure, composition of the air, and the electrical characteristics of the C and D layers.

But the ionosphere is important not only for the effect on radio transmissions and possible passenger carrying space ships, but because of its vital influence on human existence. The ionosphere protects the earth and its inhabitants. It is an insulating medium; without its filtering action the sun would probably instantly roast us. Solar radiations, which are the basis of all organic life, contain certain ultra-violet rays capable of burning us to a crisp without the dampening effect of the ionosphere and the lower atmosphere.

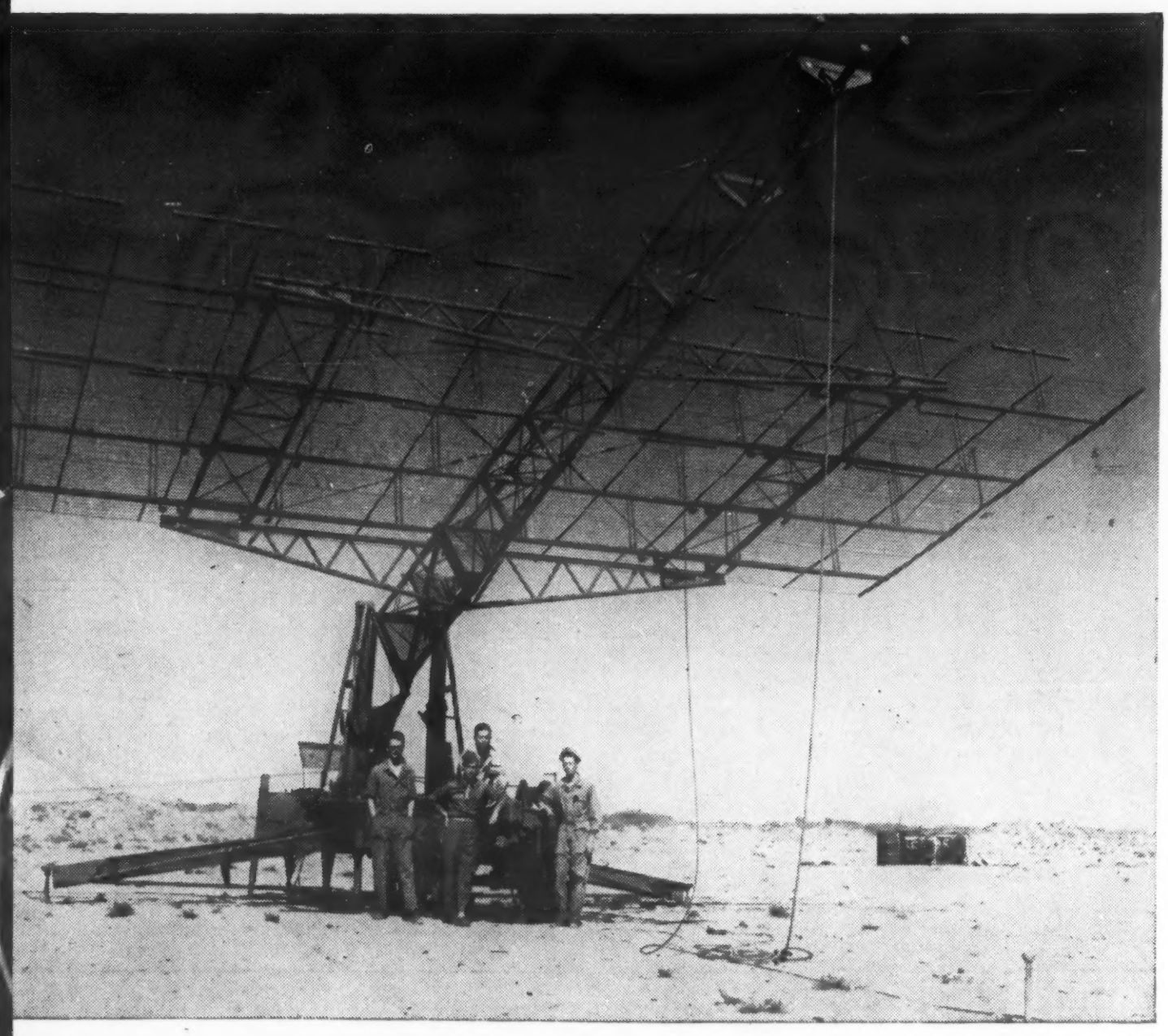
The Rocket

If the time ever comes when a rocket is built to leave the earth for the moon or one of the planets, problems arising from penetration of these peripheral layers will have to be considered. According to Dr. Michael Fer-



The "WAC Corporal," a U. S. Army Ordnance rocket.

SCR-270 in the desert, tilted for meteorite detection.



A captured German Kino-theodolite, used for tracing missiles.

(Left) The V-2 is framed by WAC Corporal firing tower. (Center) A Mieller wagon sets rocket in place on 4-ft. platform. (Right) Rocket is hoisted into position for firing.

ence, head of the Meteorological Branch of the Signal Corps Engineering Laboratories, "one of the most important problems that has plagued meteorologists for years has been the nature of the atmosphere at the very high altitudes of approximately 100 miles or higher. Scientists have long been trying to determine the density and pressure of the air at these elevations and from such measurements make deductions as to the temperatures that may exist. *Rather indirect evidence* has indicated that temperatures may reach values as high as 1000 degrees absolute."

The meteorological sounding rocket such as the Signal Corps expects to use at White Sands becomes important in upper atmospheric studies because the data it secures is a check on theory. For example, beyond the C region, 25 miles above the earth, only 1/64th of the total weight of the atmosphere remains. The entire atmosphere, all 300 or so miles of it, presses down upon the earth's surface and the atoms and molecules composing it are all packed tightly together at ground level, while similar particles in the far upper levels are widely scattered. Molecules and atoms of oxygen, nitrogen, helium and the many other gasses which make up the atmosphere in varying proportions, are packed tightly together by the weight above them; the most dense portion being at ground level.

The density is a measure of the distance each atom or molecule must travel before colliding with its neighbor within a gas. With temperature and pressure known, physicists can calculate the average distance such particles will travel, and this "mean free path" is a factor in understanding the structure of the atmosphere. When meteorologists know the exact significant values of the atmosphere's characteristics at all levels, and rockets help to reveal just how filtering of solar radiation occurs, long distance forecasting and weather control will be much nearer to realization.

It should be obvious, therefore, that the rocket experiments at White Sands far transcend their military significance. Signal Corps equipment carried by rockets will help in an understanding of solar, lunar and stellar radiations. Sounding rockets will carry instruments capable of precise and rapid measurements and which will be ejected at the top of the trajectory and probably suspended from fireproof parachutes made of asbestos and spun glass. These precautions are necessary because a free fall from such altitudes would destroy an ordinary 'chute because of the friction encountered in the dense lower levels.

Upper atmosphere studies, as highlighted by the experimental rocket firings at White Sands, are part of the scientific era—the first feeble gropings into the Atomic Age. They are but the beginning. Soon the V-2, the WAC Corporal and other rockets will seem as primitive as Stephenson's locomotive or Langley's flying machine are today. Meanwhile, it is the function of Signal Corps scientists and engineers to keep abreast of technological progress —not only for the practice of war but to open new concepts to human culture and civilization.

By Harold J. Wheelock

Video Impresario

FOLLOWING in the path of tradition, Allen DuMont went west from Brooklyn and built an industry around the cathode-ray tube on the salt flats of North Jersey.

In and around Upper Montclair, Clifton and Passaic, the DuMont Laboratories have evolved from the basement of a home, expanded through five store buildings into a former pickle factory, and are now ensconced in seventeen plants. And in the sixteen years of the organization's existence, sales have increased from a modest $70 in 1931 to a current production rate that should approximate about $25,000,000 by the end of 1947.

Dr. DuMont was an early pioneer with the cathode-ray tube, developed it from the laboratory curiosity of the 1920's into the highly complex, precision instrument now a basic component in oscillographs, loran, radar, shoran, GCA, and the television receiver. He made the first commercially acceptable tubes in 1931 and has perfected it in more than 300 types. His contribution to the Allied war effort assumes an immense magnitude in the light of the fundamental importance of the cathode-ray tube and his numerous associated patents and processes in the field of electronics. Today, in addition to industrial, military, scientific and laboratory instruments, DuMont is manufacturing a complete line of television equipment—from receiving tube to camera and transmitter. He makes the largest receivers, operates the first television network, provides the entire video cycle, from raw glass to telecast programs.

Brooklyn to Jersey

Young Allen DuMont, born in Brooklyn in 1901, was early fascinated by the bawdy, cacophonic new science of radio. At the age of twelve he was actively engaged in amateur radio, held a First Class Commercial license at fifteen, and worked as radio operator on thirteen different ships between 1916 and 1924.

Strongly impressed by the fact that an alumnus had built the Brooklyn Bridge, DuMont entered Rensselaer Polytechnic Institute in 1919, supplementing his engineering studies with vacation jobs on shipboard. It was at Rensselaer that he first became interested in the crude oscillographs used in laboratory work, the beginning of a brilliant career with the cathode-ray.

After graduation, he was employed as an engineer in the development laboratory of the Westinghouse Lamp Company in Bloomfield, later became engineer in charge of radio receiving tube production. His inventive genius soon asserted itself and he revolutionized the manufacturing process, increasing output from 1,000 to 50,000 tubes per day. He applied for numerous patents, including a high speed automatic seasoning and testing machine

. . . Allen DuMont's improvement and refinement of the high-vacuum cathode-ray tube provided visual perception for radar, loran, shoran; took the oscillograph out of the laboratory; greatly accelerated the science of television.

which functioned at the rate of 5,000 tubes per hour.

Following four years with Westinghouse, the brilliant young engineer became affiliated with the De Forest Radio Company at Passaic. First as chief engineer, then as vice president in charge of production, he was charged with the task of reorganizing a static plant that had been idle for more than a year, replacing obsolete machinery and equipment, employing technically qualified personnel, and reaching a production of 30,000 receiving tubes per day.

This program was accomplished in less than twelve months, aided by numerous new processes and equipment designed and built under his direction. These included a high speed sealing machine, high speed improved automatic grid winding and welding machine, high speed base branding machine, high speed basing and wire cutting machine, a high frequency tube bombarder, an improved electric welding machine, and various test equipment and life test racks.

Introduction to Television

Before and during the incubative period of radio, many experimenters and scientists had been obsessed with the idea of transmitting pictures, with and without wire circuits. Key date in the pre-history of television is probably 1817, when Baron Jons Jacob Berzelius of Sweden isolated selenium, a material that May found capable of transforming light into electric energy in 1873.

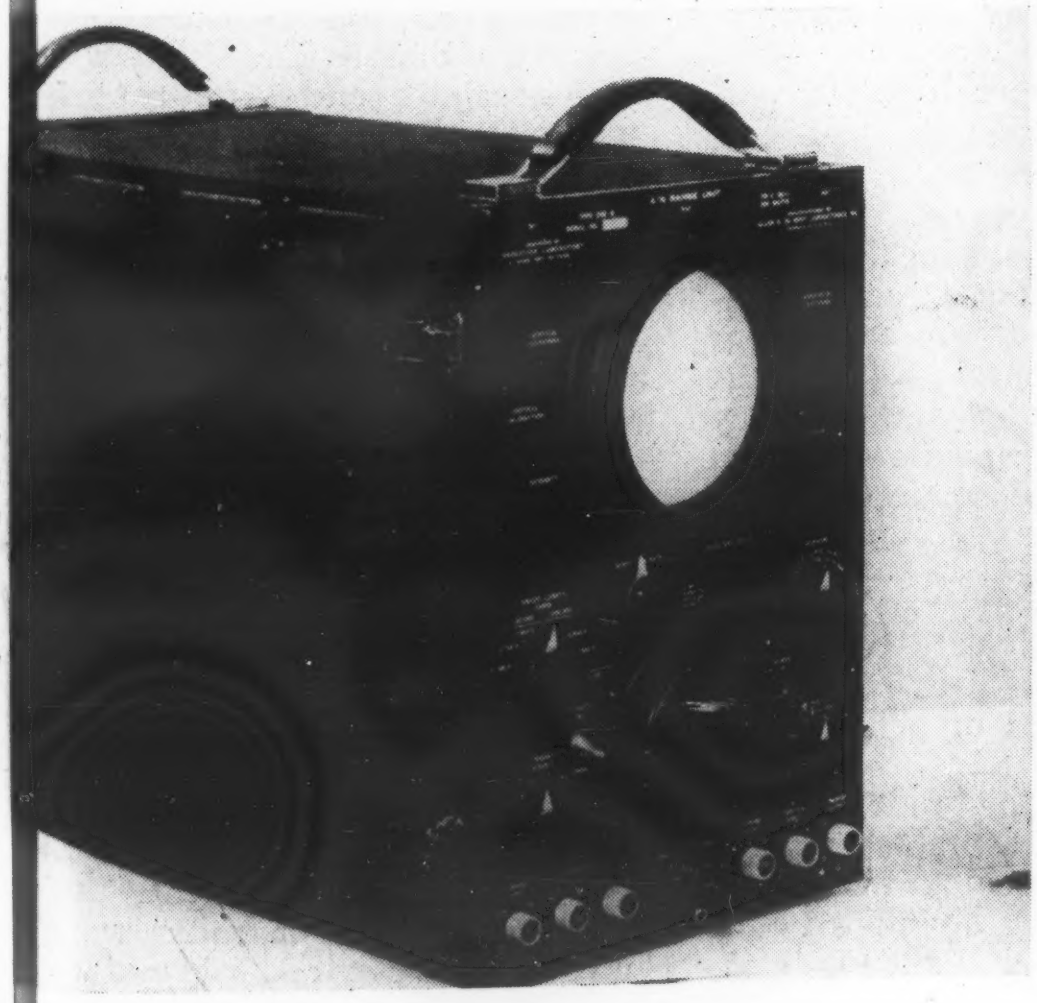
By 1880 the principle of picture-scanning had been described by Le Blanc and in 1884 Paul Nipkow patented a method that used a spinning disk with holes punched near the edge in spiral form. By revolving the disk at 20 to 30 revolutions per second and projecting the light on selenium cells, variations in light and shadow were made to generate electric currents that were directly proportionate to the brightness of the source.

Karl Braun invented the cathode-ray tube around the turn of the century. This early tube consisted of a magnet-controlled electron stream projected onto a chemical deposit in a vacuum tube. Boris Rosing, of Russia, patented an electronic television receiver in 1907 but the transmitting equipment still utilized the Nipkow disk.

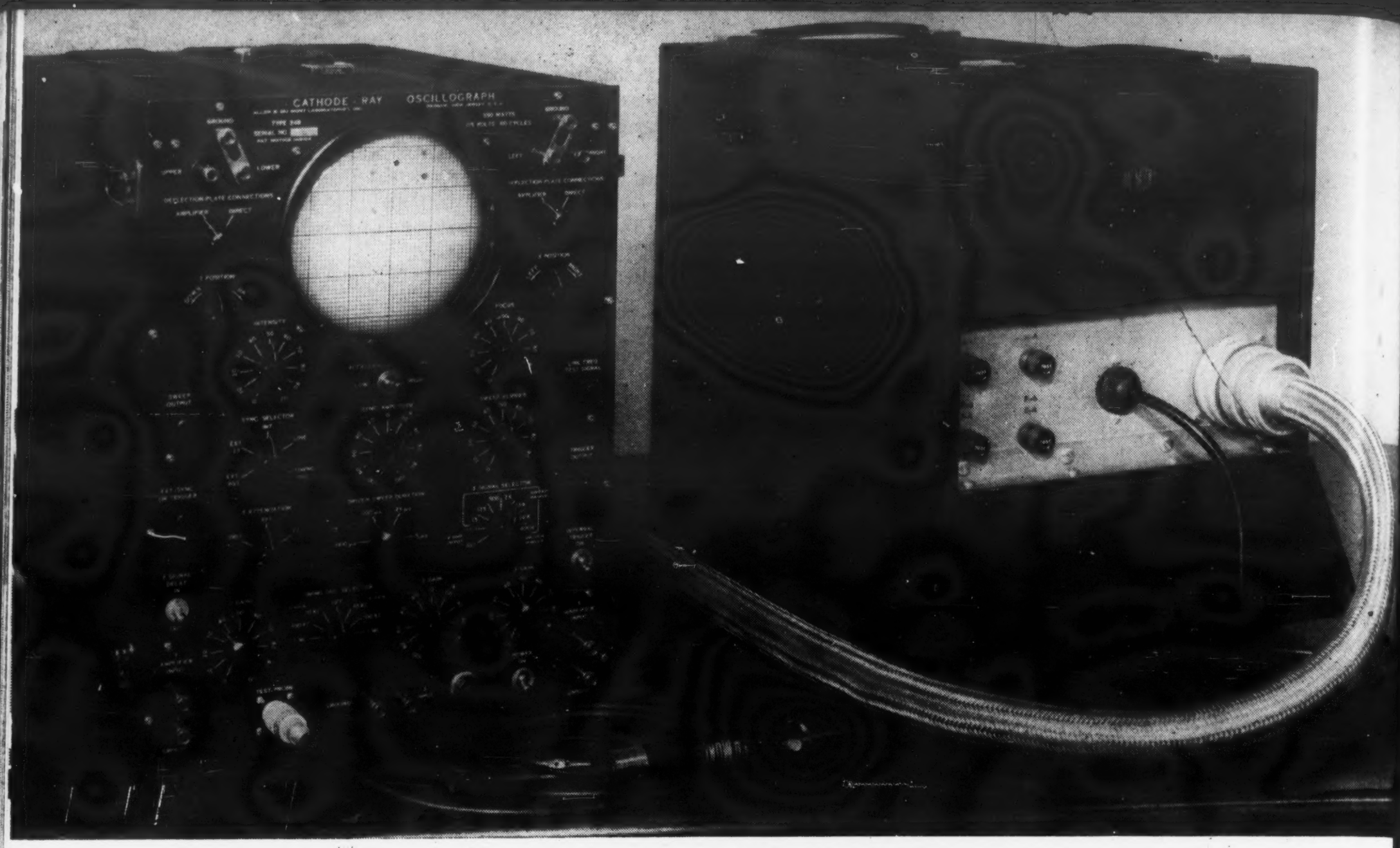
The World War interrupted further development until 1925, when almost simultaneous demonstrations of mechanical television systems were made by John Baird in England and C. F. Jenkins, near Washington, D. C. For another decade television was bound to the hybrid mechanical scanner and electronic receiver system.

Experiments were early under way to produce an electronic scanning device, culminating in 1923 when Vladimir Zworykin patented his "iconoscope," followed by Philo Farnsworth's "image dissector." Both systems used photoelectric plates that emitted electrons in amounts commensurate with the brightness of the image. Insulated photosensitive particles were deposited on a mica sheet in the iconoscope. An electron "gun" at the front of the tube controlled the scanning process. The emitted electrons replaced those lost from the plate—a "storage" characteristic that greatly increased the sensitivity of the tube. The more recent "orthicon" is a still more sensitive version of the basic iconoscope.

This Radar Range Unit was a top priority project



The Cyclograph makes analytical tests on metals



The Type 248 Oscillograph was used in the Manhattan Project

De Forest in the Field

The De Forest Radio Company bought the basic Jenkins patents in 1929 and built experimental stations in Passaic, Jersey City and New York. Using the Jenkins mechanical drum, the Passaic station was the first to broadcast sight and sound simultaneously.

His old interest in the cathode-ray tube revived, Allen DuMont became engaged in the De Forest television projects and soon had patented several new tubes, improved machinery and other apparatus. He readily perceived the possibilities for application of the cathode-ray technique, particularly in television receivers.

When RCA bought the De Forest interests, DuMont found himself unemployed and facing a major personal crisis. Although the economic depression had stifled the industrial growth of the nation, he decided to cast his future with a new field—the cathode-ray tube and the incipient television industry.

The cathode-ray tube was still a museum piece, with an extremely short life of about twenty-five hours. Complexity and expense of manufacture confined this exceedingly valuable research instrument to a few laboratories and prevented its extension into the industry. To bring the cathode-ray tube into the commercial market-place was the task DuMont tackled.

As the first step, in June 1931 he began experimenting in the basement of his home in Upper Montclair, New Jersey, and, with a total capital investment of $500, he hired several glass blowers and bought equipment. Although constantly beset by financial difficulties, the small enterprise grew erratically and by 1934 had expanded into a group of five store buildings in Upper Montclair.

Progress was steady, however, and the newly incorporated Laboratories soon outgrew their new quarters. DuMont sold the patent rights to one of his new inventions, the cathode-ray tuning indicator, or "Magic Eye," to RCA for $20,000 and used the money to buy a former pickle works in Passaic, still the main plant of the Laboratories.

In the Pickle Factory

Once finances were on a firm footing, progress was swift and DuMont's record of achievement is impressive. His organization manufactured the first line of commercially acceptable cathode-ray tubes and oscillographs in the United States; developed the electronic switch, allowing observation of two or more waves simultaneously; perfected the time-delay tube with phosphorescent screen; invented tuning indicators; built special cathode-ray tubes for the radio compass, industrial, military and other medical applications; developed and manufactured the largest cathode-ray tubes available for oscillograph and television use; designed the Resonoscope as a standard for musical frequencies. Many other patents have been granted either to Dr. DuMont or his associates and have contributed notably to the advancement of the art.

As early as 1932 he became interested in the military application of the cathode-ray tube. During that year he worked with the Signal Corps in experiments designed to develop a direct-indicating locator for gun spotting, based on the cathode-ray. In 1933 he proposed the cathode-ray compass and fog-penetrating techniques; during 1935 he collaborated with Captain Clayton of the Signal Corps in the use of thermo-couples for the detection of ships by infra-red radiations from their funnels.

A method of "locating the direction from which light, heat, infra-red, sound or radio waves come" was described and reduced

to drawings in April 1933 by DuMont. This system incorporated the cathode-ray tube in what is basically the receiving system of radar. A transmitter was included, the reflected waves of which would provide all the remaining elements of a radar set. After discussion with Signal Corps technicians, he was dissuaded from filing patents because such action would reveal the military application of the system. When DuMont again tried to patent his version of radar in 1939, he found that other experimenters in Europe had registered similar systems in 1937, four full years after his original drawings had been made.

DuMont supplemented his activities with a European trip, where he made an intensive study of foreign television techniques. In the late 1930's he had again returned to the video field and operated experimental transmitting stations in Passaic and New York. His all-electronic receiver, first manufactured in 1939, six months before any other firm—was the only immediately available apparatus for general use during the New York World's Fair demonstrations. His organization had a strong reservoir of engineering and manufacturing experience in the field before the wartime hiatus.

The War

The opening of hostilities in Europe throttled television operations and DuMont Laboratories were alerted for emergency production. It was immediately obvious that the new conflict would favor technology and that the relatively new science of electronics would perform a vital function. As the leading manufacturer and developer of the cathode-ray tube, DuMont was to find ready application for his products. Beginning with aid to Britain for their early radar equipment, he soon was producing tubes and instruments for all of the armed forces.

Initial government orders were for portable radio transmitter-receivers for the Signal Corps. As war demands reached flood-tide, DuMont burst out of the pickle works, built an adjoining annex for tube production, established an instrument plant in Clifton, and occupied various other buildings in Passaic for engineering and special development services.

A cohesive, loyal group of engineers and technicians with laboratory training and practical manufacturing experience enabled DuMont to perform prodigies of speed and production. Typically—the Type 326A, 7" cathode-ray tube, manufactured before the war by Western Electric and the only commercial model then in production by a firm other than DuMont, was in critically short supply. DuMont was asked to duplicate the tube and within five days the 326A was rolling off the production line.

In addition to the increase required in plant capacity, personnel was multiplied fifty-fold overnight and production rose by a factor of several hundred. From two dozen employees at the end of 1936, DuMont increased to 1200 in June 1945. The basement spawned enterprise had become big business in fifteen years.

Sub contracting was resorted to as a means of streamlining production and, with many other manufacturers, DuMont shared his patents with numerous competitive firms throughout the country. He helped train engineering and production personnel in cathode-ray techniques for such companies as Sylvania, National Union, General Electric, North American Phillips.

Unretouched photograph transmitted over WABD, March 1945

Products of the Laboratories ran the entire gamut of electronic weapons: Plan Position Indicator; PPPI; oscilloscopes for every type of radar, shoran, loran and GCA; transmitting equipment for loran; the bearing amplifier converter; A/R range scope; link equipment for coordinating air and seaborne radar; loran timer and switchgear; loran transmitter monitors; mortar-fire radar; underwater sound amplifier; the radial deflection indicator.

Standard DuMont oscillographs were made for every conceivable war and industrial application. The Type 248, aristocrat of the line, was used in the Manhattan Project and contributed notably to the achievement of atomic fission.

Wartime DuMont refinements and improvements in cathode-ray tubes have contributed greatly to their wide application. The Laboratories made the first 2-inch neck tube for high altitudes and severe climatic conditions; simplified the getter; developed platinum sputtering for screen application; produced the long

persistence screen, the anti-glare process, the flow-coating process, flatter-face large diameter tubes, the peripheral stem, double-beam tubes, anti-halo tubes, and a high-frequency tube for frequencies up to 3,000 megacycles. Truly, the electronic stream in the cathode-ray tube was a potent factor in tracing the pattern of Allied victory.

Post-war Television

With the termination of hostilities, Allen DuMont once again returned to television as the most promising field for the cathode-ray. His video activities had not been entirely dormant during the war: he had been operating a New York station since mid-1942 on a regular weekly schedule.

Prior to the second World War, television growth had been sporadic and most broadcasts were on an experimental basis. Electronic systems with 240-line definition were in use by 1935 and in the following year RCA was delivering a 343-line picture from the top of the Empire State Building. The standard was increased to 441 lines in 1936 with 30 pictures per second and reached the present specification of 525 lines in 1941. Sound is broadcast with frequency modulation, allowing a 75 kc. swing.

Zenith, NBC and Don Lee were on the air with regular schedules in 1939 and General Electric began tests in November of that year. All operations were experimental. The DuMont Laboratories first went on the air with tests from New York in 1940 and the FCC revised its rules and set up new frequency channels and authorized the first commercial operation.

Television receivers were confined to a few restricted locations before the war. The New York area had about 6,000 sets in 1941, when the first commercial programs of NBC and CBS were broadcast, each with a 15-hour weekly schedule. There were a few sets around Albany and Schenectady, some in Chicago and about 1,000 around Los Angeles. To the remainder of the country, television was an esoteric toy that lacked tangible substance.

Although Pearl Harbor had silenced most of the stations, both DuMont and General Electric had adopted a policy of accepting commercial programs prepared by advertising agencies in early 1943—lifting television out of the amateur status.

Attacking the challenge of commercial television with characteristic vigor and thoroughness, Allen DuMont's purview encompassed the entire field. Since 1939 he had been manufacturing electronic television receivers and video transmitters; he was making his own test equipment, monitors, and orthicon cameras for studio and outdoor pickup. With the scheduling of regular programs DuMont provided a television service that was complete, from laboratory to living room.

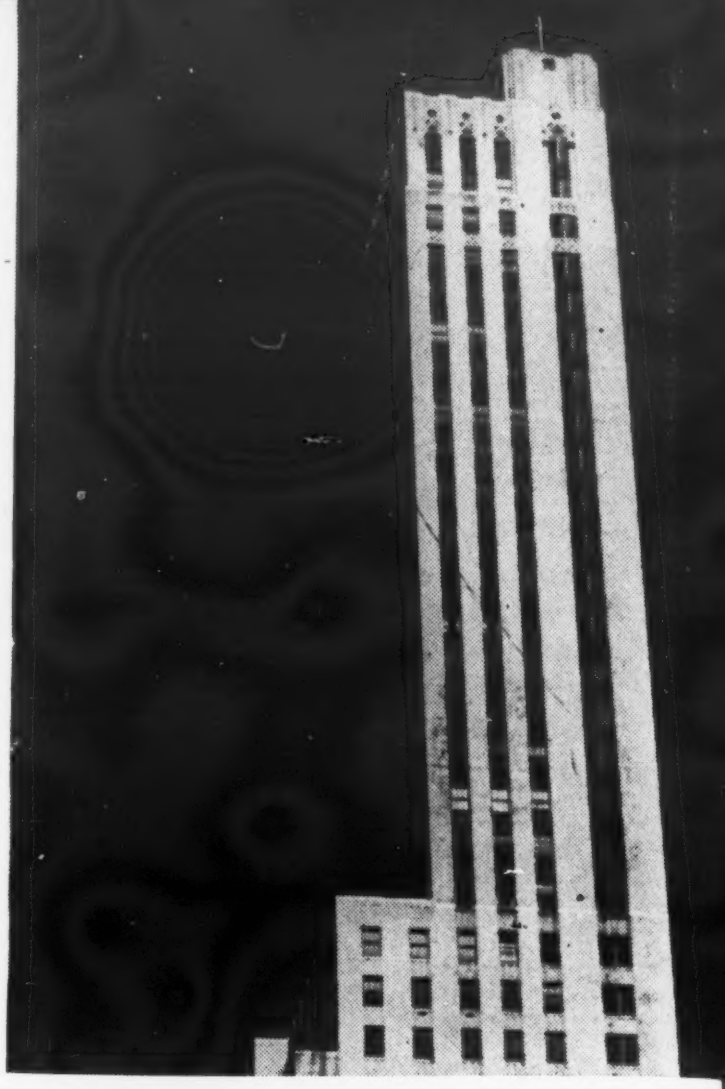
Station WABD, DuMont's New York outlet, transmitted the first program through the coaxial cable of A. T. & T. early in 1946, for release through the Washington station, WTTG. For this performance Dr. DuMont was given the top award of the American Television Society for the "year's outstanding contribution to the commercial development of television."

With full commercial operation in two cities, DuMont is televising a series of programs that provides a wide variety of home entertainment: plays, opera, speeches, films, concerts, football, boxing, baseball, basketball, ice hockey. The television diet is well balanced.

Exemplary of the continuing technical advancement of DuMont and his associates are two of their more recent processes. The Telerecorder is a device for recording television sight and sound on 16-millimeter film for re-broadcast, spot programs and networks. The Inductive Tuning System for FM and television receivers, now used on DuMont sets, provides full band coverage in the ultra-high range with optimum performance in gain and image rejection.

Dr. Allen B. DuMont is today a dominant figure in television, has ambitious future plans. He has applied for channels in Pittsburgh, Cleveland and Cincinnati; is currently building over $1,250,000 worth of television receivers per month, with tubes varying from 7 to 20 inches, largest in production; continues to manufacture the most complete line of oscillographs and other cathode-ray test equipment; builds orthicon cameras, monitors and video transmitters.

Recognition has come to DuMont from many sources. In 1944 he was given the honorary degree of Doctor of Engineering by his alma mater, Rensselaer Polytechnic Institute for "pioneering in the development and use of the cathode-ray tube, the heart of radar . . . and his improvement of the art and science of television . . ." He was similarly cited for the Engineering Award of the Television Broadcasters Association in 1944 and was given the Marconi Memorial Medal of Achievement by the Veteran Wireless Operators Association in 1945 for pioneering work in communications. In March 1947 the annual Advertising Award was made to him by the Advertising and Selling Magazine, "for his contributions to the advancement of television as a new service to the public and as a new medium of advertising."



WABD antenna at 515 Madison Avenue, New York

Television is a science that has barely reached into the inchoate phase. Dr. DuMont does not contend that it will immediately replace radio or the theatre. But there is a very definite future for the video art—one that should revolutionize the popular concept of home entertainment, provide vision for a medium that learned to talk and sing and reproduce music two decades ago. As Marconi and De Forest gave radio its vocal chords, Allen DuMont and other scientists are nursing its optic nerves to life.

RADIO-RELAY and the WAR

By John J. Kelleher

Engineering and Technical Service
Office of the Chief Signal Officer

. . . the conclusion of a survey of VHF in air, ground and wire integration

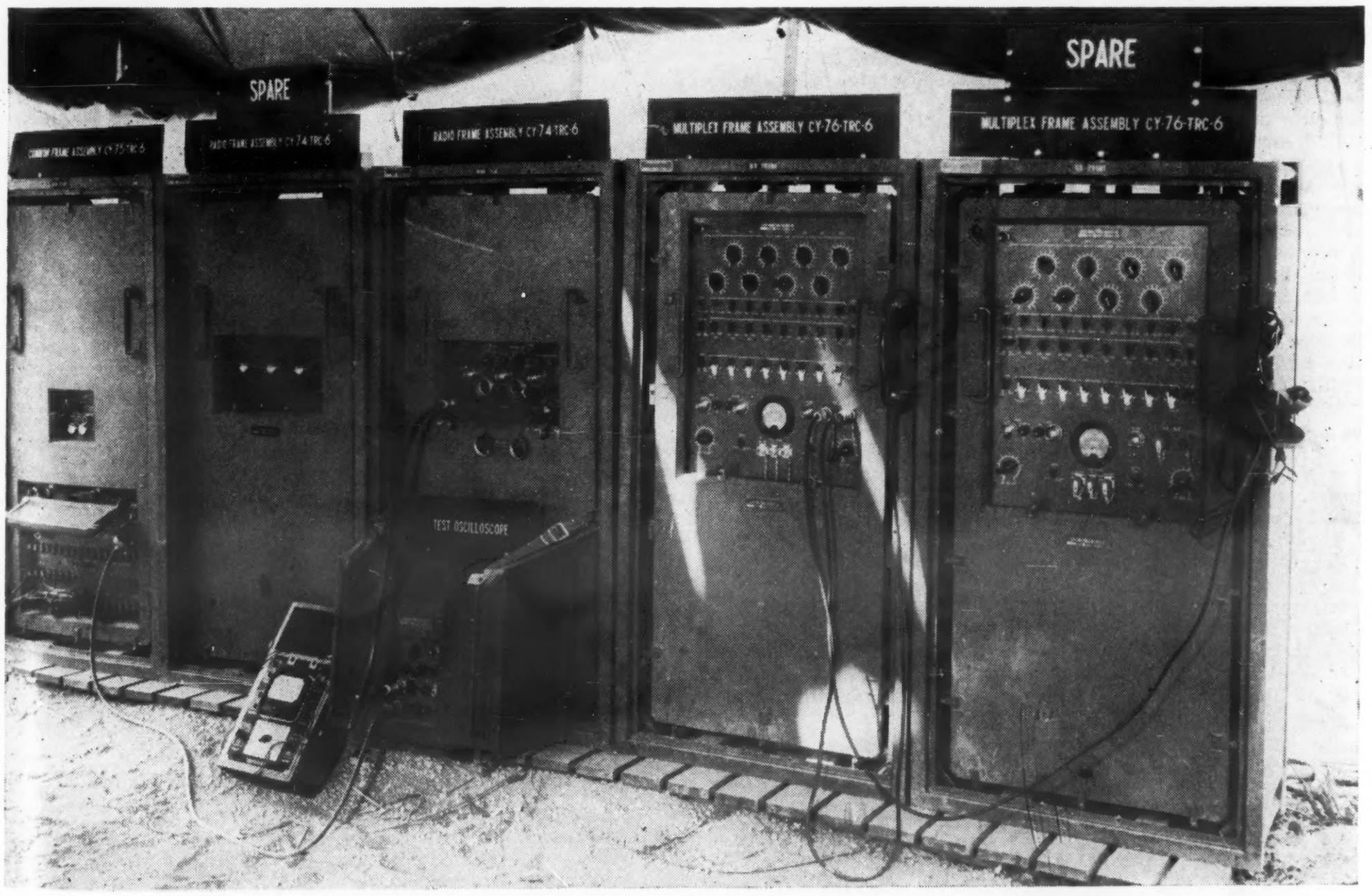
WHILE VHF was being rapidly developed for aircraft and combat use, at Division level and above wire continued to be the primary means of communication, supported by standby high frequency radiotelegraph circuits. It was standard practice to use either wire or radio as the technical and operational characteristics of the two system differed so widely that it was considered impractical to establish a direct electrical liaison between the two. The closest approach to integration was the remote control for radio sets by means of which they could be controlled from a central operating point, thus facilitating the transfer of traffic.

Hybrid systems of radio and wire circuit integration had been in commercial use for several years prior to 1940 for such purposes as ship-to-shore telephone, river crossings, inter-island telephone circuits, bridging of major line breaks until wire service could be restored. These applications were equally feasible for military radio "links" in the wire system and there were other important considerations.

Logistics was a prime problem. It took a staggering amount of shiptons to transport the appurtenances of pole-line construction. Maintenance was tremendously important. Pole-line and cable routes had to be patrolled throughout their length to repair damage inflicted by bombs, saboteurs and friendly vehicular traffic. Regardless of the need, high frequency radio links in wire systems was considered practical only in fixed station operations under carefully controlled operating conditions and was not thought adaptable to conditions encountered in active field military campaigns.

The development of FM equipment completely negated the prejudice against radio links; provided a radio transmission facility that had none of the faults of high frequency; was extremely small, rugged, easily portable, yet had many of the attributes of a high quality wire circuit. Audio levels could be maintained within close limits over long periods of time because fading was practically nonexistent at those portions of the spectrum; signal-to-noise ratios were amazingly high, right out to the maximum range of the circuit; most important, multipath distortion was completely absent and the fidelity of the circuit could be held at a level that permitted relaying the signals by tandem connected receivers and transmitters, far beyond the horizon range of a point-to-point circuit. Finally, the range and quality of the circuit could be enhanced by the use of highly directional antennas which are of practical dimensions on VHF.

From the beginning it was realized that integration could only be achieved if the radio equipment had all the electrical characteristics of a wire line, permitting the use of standard ter-



Operating and spare components of Radio Set AN/TRC-6.

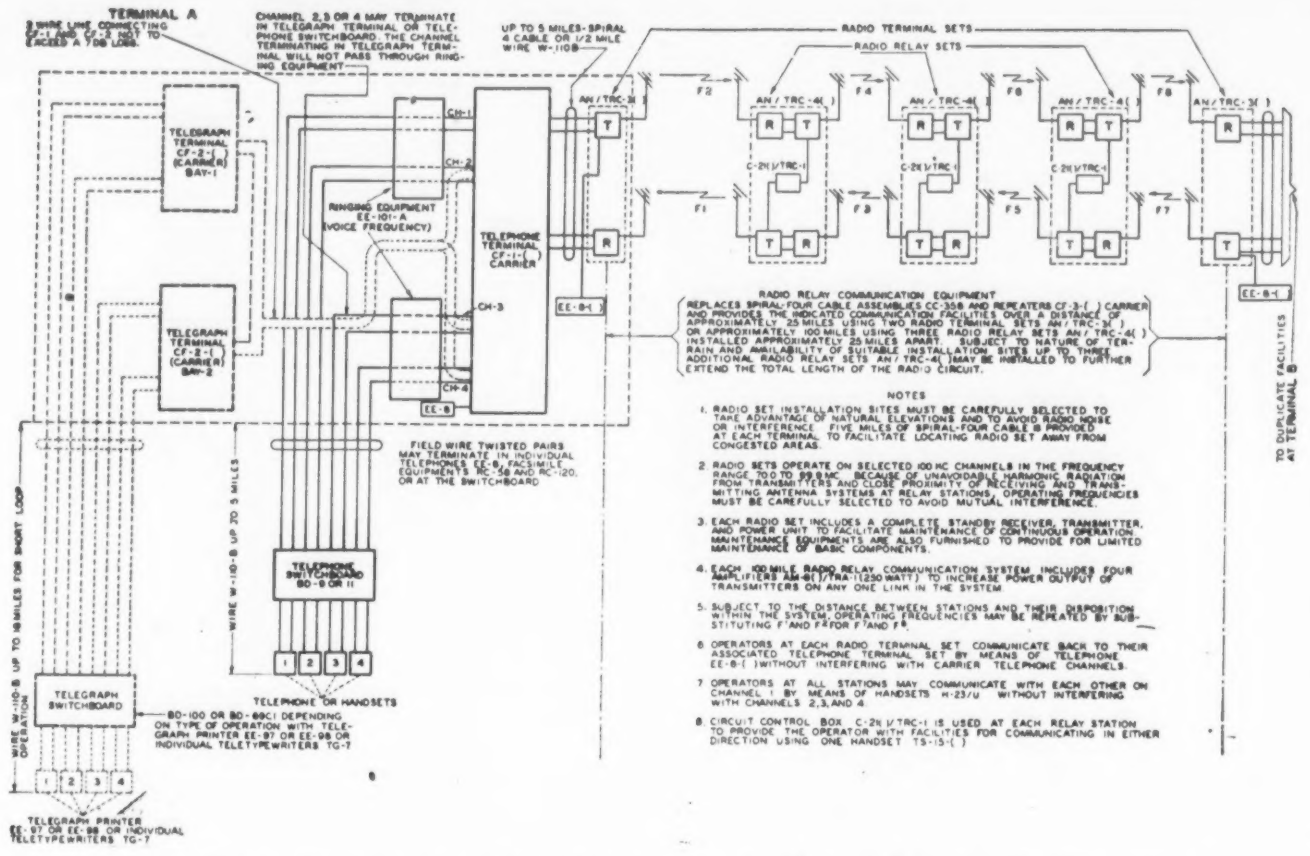

TERMINAL A
2 WIRE LINE CONNECTING CF-1 AND CF-2 NOT TO EXCEED A 7 DB LOSS.
CHANNEL 2, 3 OR 4 MAY TERMINATE IN TELEGRAPH TERMINAL OR TELEPHONE SWITCHBOARD. THE CHANNEL TERMINATING IN TELEGRAPH TERMINAL WILL NOT PASS THROUGH RINGING EQUIPMENT.
UP TO 5 MILES- SPIRAL 4 CABLE OR 1/2 MILE WIRE W-110B
RADIO TERMINAL SETS
RADIO RELAY SETS
TELEGRAPH TERMINAL CF-2-( ) (CARRIER) BAY-1
TELEGRAPH TERMINAL CF-2-( ) (CARRIER) BAY-2
RINGING EQUIPMENT EE-101-A (VOICE FREQUENCY)
TELEPHONE TERMINAL CF-1-( ) CARRIER
CH-1
CH-2
CH-3
CH-4
EE-8
EE-8-( )
AN/TRC-3( )
AN/TRC-4( )
C-2N(V)TRC-1
F1
F2
F3
F4
F5
F6
F7
F8
RADIO RELAY COMMUNICATION EQUIPMENT
REPLACES SPIRAL-FOUR CABLE ASSEMBLIES CC-356 AND REPEATERS CF-3-( ) CARRIER AND PROVIDES THE INDICATED COMMUNICATION FACILITIES OVER A DISTANCE OF APPROXIMATELY 25 MILES USING TWO RADIO TERMINAL SETS AN/TRC-3( ) OR APPROXIMATELY 100 MILES USING THREE RADIO RELAY SETS AN/TRC-4( ) INSTALLED APPROXIMATELY 25 MILES APART. SUBJECT TO NATURE OF TERRAIN AND AVAILABILITY OF SUITABLE INSTALLATION SITES UP TO THREE ADDITIONAL RADIO RELAY SETS AN/TRC-4( ) MAY BE INSTALLED TO FURTHER EXTEND THE TOTAL LENGTH OF THE RADIO CIRCUIT.
NOTES
1. RADIO SET INSTALLATION SITES MUST BE CAREFULLY SELECTED TO TAKE ADVANTAGE OF NATURAL ELEVATIONS AND TO AVOID RADIO NOISE OR INTERFERENCE. FIVE MILES OF SPIRAL-FOUR CABLE IS PROVIDED AT EACH TERMINAL TO FACILITATE LOCATING RADIO SET AWAY FROM CONGESTED AREAS.
2. RADIO SETS OPERATE ON SELECTED 100 KC CHANNELS IN THE FREQUENCY RANGE 70.0 TO 99.9 MC. BECAUSE OF UNAVOIDABLE HARMONIC RADIATION FROM TRANSMITTERS AND CLOSE PROXIMITY OF RECEIVING AND TRANSMITTING ANTENNA SYSTEMS AT RELAY STATIONS, OPERATING FREQUENCIES MUST BE CAREFULLY SELECTED TO AVOID MUTUAL INTERFERENCE.
3. EACH RADIO SET INCLUDES A COMPLETE STANDBY RECEIVER, TRANSMITTER, AND POWER UNIT TO FACILITATE MAINTENANCE OF CONTINUOUS OPERATION. MAINTENANCE EQUIPMENTS ARE ALSO FURNISHED TO PROVIDE FOR LIMITED MAINTENANCE OF BASIC COMPONENTS.
4. EACH 100 MILE RADIO RELAY COMMUNICATION SYSTEM INCLUDES FOUR AMPLIFIERS AM-4( ) (TYP 1250 WATT) TO INCREASE POWER OUTPUT OF TRANSMITTERS ON ANY ONE LINK IN THE SYSTEM.
5. SUBJECT TO THE DISTANCE BETWEEN STATIONS AND THEIR DISPOSITION WITHIN THE SYSTEM, OPERATING FREQUENCIES MAY BE REPEATED BY SUBSTITUTING F' AND F" FOR F AND F".
6. OPERATORS AT EACH RADIO TERMINAL SET COMMUNICATE BACK TO THEIR ASSOCIATED TELEPHONE TERMINAL SET BY MEANS OF TELEPHONE EE-8-( ) WITHOUT INTERFERING WITH CARRIER TELEPHONE CHANNELS.
7. OPERATORS AT ALL STATIONS MAY COMMUNICATE WITH EACH OTHER ON CHANNEL 1 BY MEANS OF HANDSETS H-23/U WITHOUT INTERFERING WITH CHANNELS 2, 3, AND 4.
8. CIRCUIT CONTROL BOX C-2N(V)TRC-1 IS USED AT EACH RELAY STATION TO PROVIDE THE OPERATOR WITH FACILITIES FOR COMMUNICATING IN EITHER DIRECTION USING ONE HANDSET TS-13-( )
TO DUPLICATE FACILITIES AT TERMINAL B
FIELD WIRE TWISTED PAIRS MAY TERMINATE IN INDIVIDUAL TELEPHONES EE-8, FACSIMILE EQUIPMENTS RC-56 AND RC-120, OR AT THE SWITCHBOARD
TELEPHONE SWITCHBOARD BD-9 OR 11
WIRE W-110-B UP TO 5 MILES
WIRE W-110-B UP TO 10 MILES FOR SHORT LOOP OR 5 MILES
TELEPHONE OR HANDSETS
TELEGRAPH SWITCHBOARD
BD-100 OR BD-69C1 DEPENDING ON TYPE OF OPERATION WITH TELEGRAPH PRINTER EE-97 OR EE-98 OR INDIVIDUAL TELETYPEWRITERS TG-7
TELEGRAPH PRINTER EE-97 OR EE-98 OR INDIVIDUAL TELETYPEWRITERS TG-7

Fig. 1. Block diagram of radio relay communication system, illustrating use of radio sets with standard terminal apparatus.

minal and switching apparatus and standard operating procedures and techniques. Consequently the Signal Corps Laboratories directed their early efforts toward providing VHF radio which could be used with the multi-channel carrier telephone equipment which had already been developed for use with open wire lines and cables.

First Equipment

To OBTAIN quickest results it was decided to modify existing commercial or military VHF radio sets for this type of service, and a hastily conducted series of tests indicated that the most likely equipment was a 70-100 mc. FM set originally designed for commercial police service. In December 1942 a contract was placed for redevelopment of this unit for radio relay. Specifications required it to be easily portable, rugged, weatherproof, simple to operate, and capable of continuous service. Audio fidelity characteristics specified were previously unattainable in military radio. The audio channel had to pass the band 200 to 12,000 cycles with so little distortion that no less than eight receivers and transmitters could be used in tandem without severe loss of fidelity. Development models were received in late 1943; engineering and service tests were conducted in a very short time; and production on a large scale began in December of that year. Many thousands of these sets were manufactured during the ensuing 18 months. They saw service in every major operation, beginning with the crossing of the English Channel in June 1944.

Radio relay had its initial field trial early in the war. In November 1942 North Africa was invaded. Late in December, General Eisenhower's Signal Officer, facing a critical communications shortage because of the unexpectedly rapid advance across eastern Algeria and Tunisia, made an urgent request for additional equipment. A month later, a group of six Signal Corps laboratory engineers arrived in Algiers with a supply of police-type FM equipment which had been hastily procured in the States. They soon succeeded in assembling the equipment and, with borrowed British tone-telegraph apparatus, devised the first military radio relay system ever used in combat. This circuit comprised eight stations extending from Algiers eastward to the island of Malta. This project provided the laboratory engineers with much valuable data which could otherwise have become available only after the equipment then under development had been placed in active service. The battlefield was the experimental laboratory for radio-relay.

Figure 1 shows, in block form, the manner in which radio-relay is employed. The radio terminal and radio-relay sets are, in effect, a four-wire transmission system and can be used to integrate with, or replace, the wire transmission medium. The terminal sets, for instance, may be employed to bridge a short gap in an otherwise all-wire system, or the wire may be discarded entirely and radio used exclusively. It is in this latter role that it proved most useful for, unlike wire, the radio links could be stretched!!

When design specifications were first indicated, a normal separation between adjacent stations of 25 miles was planned so a five-station system would cover the same 100-mile span as a spiral-four cable system. However, it was found possible to locate the terminal and relay installations on heights which permitted separations of 75 to 100 miles between adjacent stations, thus permitting the use of a normal five-station system for distances greatly in excess of 100 miles.

These first radio-relay sets were produced in three different versions which, like the 508 series, differed only in the number of components. The AN/TRC-1, used primarily by the Army Air Forces, included an absolute minimum of components: one receiver, one transmitter, one power unit. The AN/TRC-3 was intended for use at the terminals of a multi-channel system and was provided with two transmitters and ceivers, plus corresponding numbers other accessories, such as power u and antennas. Radio Relay AN/TRC-4 was used to relay sign along the system and was furnish with three receivers and transmitte and appropriate numbers of auxilia components.

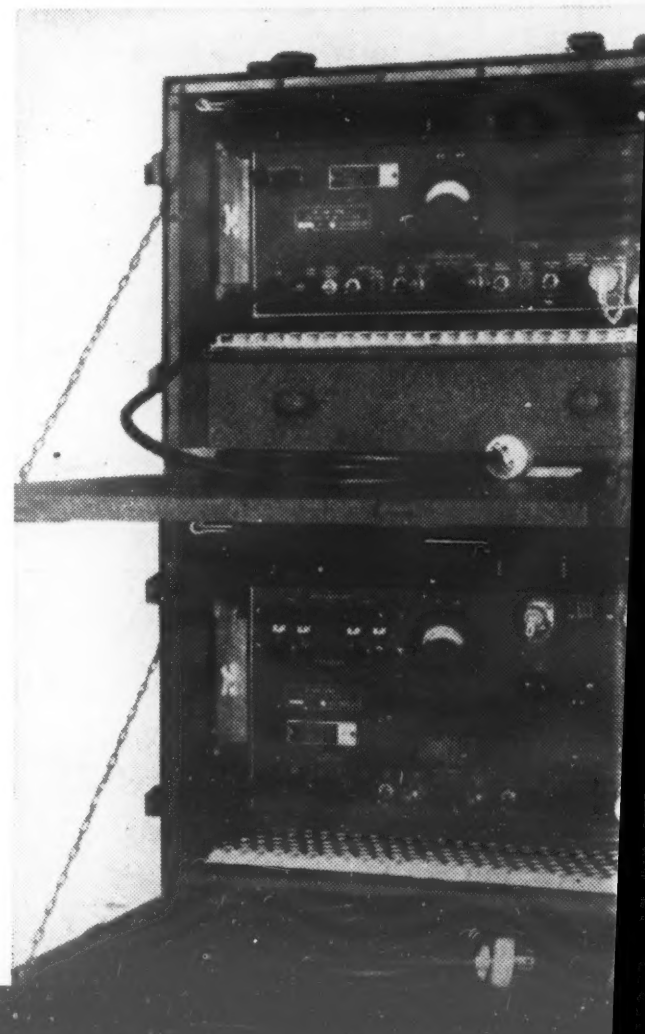
A closeup of the receiver and tra mitter, ready for operation, is sho in Figure 2. Both are crystal co trolled on any one of 300 differe channels, spaced at 100 kc. interva The transmitter is orthodox, emplo ing phase modulation and a multip cation factor of 96 between crys oscillator and output frequency, order to minimize distortion. T audio system is substantially flat b tween 250 and 12,000 cycles, the tra mitter has an RF power output 50 watts, and the maximum frequen deviation, at full modulation, ∓30 kc.

The receiver is a double-conversi superheterodyne, employing one those devilishly ingenious schemes using one harmonic from a sing crystal oscillator for the first co version and a lower harmonic the same oscillator for the seco conversion; meaning that you n only have to tune the front e of the receiver every time change frequency, but must also tu the crystal oscillator, several double and the entire first IF channel. Th with the frequency multiplication 96, caused voluminous cussing duri the tuning process and provided so very interesting information on t number of different harmonics of t crystal oscillator other than the desire 96th that could be radiated, and ho many frequencies the receiver wou respond to, other than that for whi it was resonated. Such was the pri of interim, stop-gap methods.

Field Application

EQUIPMENT was available, howeve and that was the important facto With it, the English Channel wa

Fig. 2. Major components of Radio Sets AN/TRC-1, TRC-3 and TRC-4. Receiver R/19/TRC-1 at top, Transmitter T-141/TRC-1 below.



spanned with multi-channel communications on D plus one, and it was due primarily to the mobility of this equipment that our troops had communications during their sweep across France to the German border. In the Pacific, too, radio-relay had many uses. First at Hollandia, where swamps and rivers prevented the installation of wire; next at Leyte, where it was used for ship-to-shore circuits and in many administrative and command nets between the force headquarters at Tacloban and the various subordinate headquarters scattered over the islands. It was used extensively in the Luzon operation, and proved of considerable value in communications throughout the Pacific area. Even after hostilities ceased the equipment continued in use because many months elapsed before the fixed facilities of occupied areas could be restored to service.

The antenna system used with the TRC-4 is a three-element, parasitic array having a forward gain of some 6 db., a front-to-back ratio of 8 to 18 db., dependent upon the accuracy of adjustment, and a beam width at half-power of about 75 degres.

A 250-watt amplifier, complete with power supply was also provided for those cases which needed an extra 5 or 6 db. in order to push through a usable signal. The amplifier was never too successful as it was soon found that a rhombic antenna would also provide the additional gain and was much easier to transport than the amplifier.

Although this equipment performed excellently, it was still considered only a stop-gap and, almost as soon as it was conceived, the development of improved replacements began. Profiting by experience, it was decided to simplify the new set, AN/TRC-8, and to dispense with crystal control, if possible. Development of the unit was started early in 1943 but progress was slow; final models did not become available until early in 1945, and production was just beginning at war's end.

This unit, while functionally similar to the AN/TRC-1 series, differs in several important respects. It operates at a higher frequency—230 to 250mc.—is continually tuneable over that band, and employs temperature-compensated concentric lines for frequency control instead of crystals.

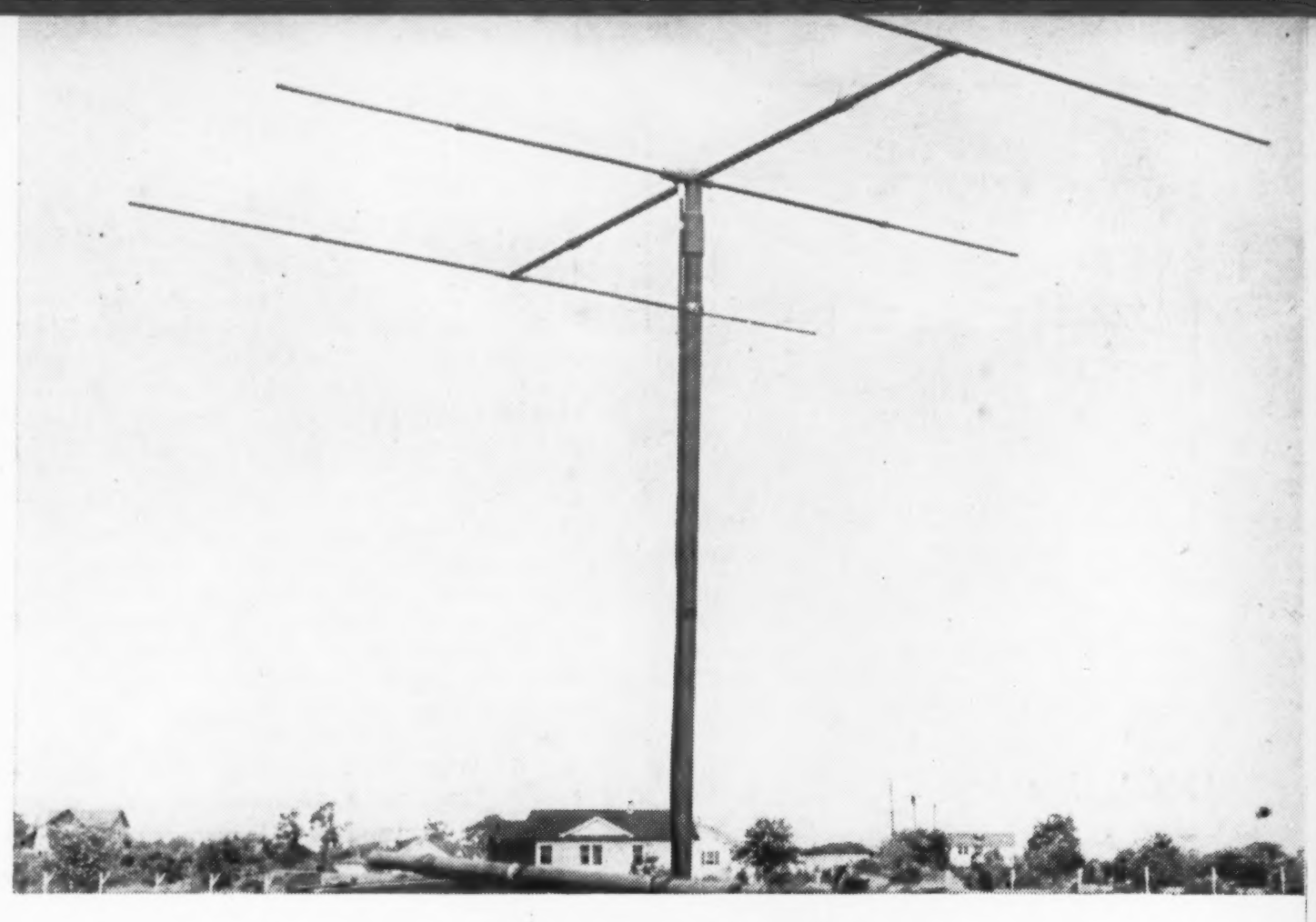


Fig. 3. Antenna system AS-19/TRC-1 is used with AN/TRC-1, -3, and -4. Designed for both transmission and reception, the beam is mounted atop a 50-ft. sectional steel mast.

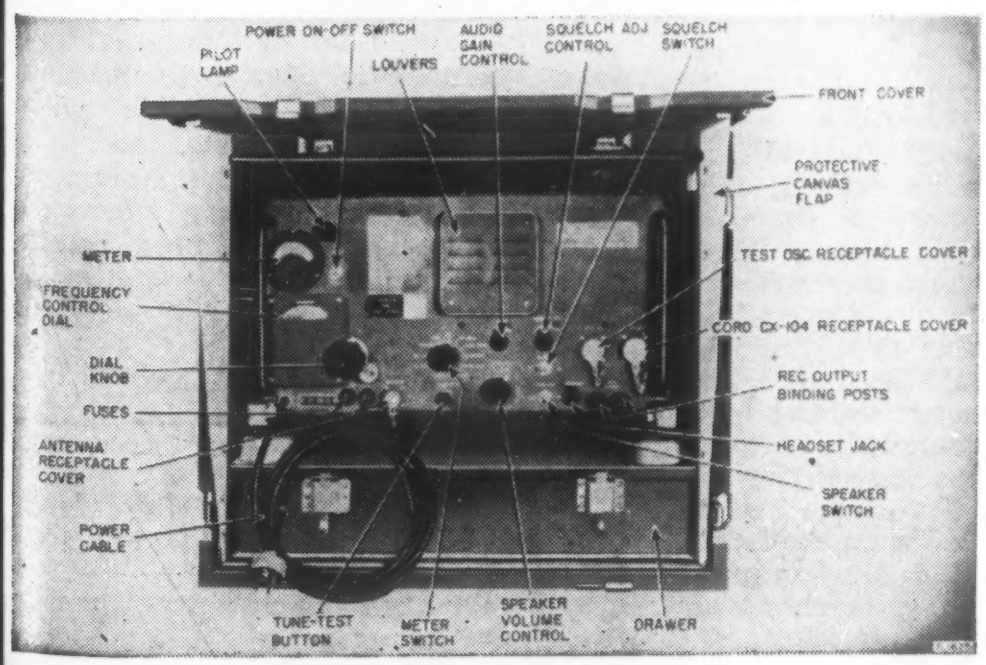
Audio fidelity is improved, and the equipment includes an antenna system which is simple and compact, yet provides a high degree of directivity.

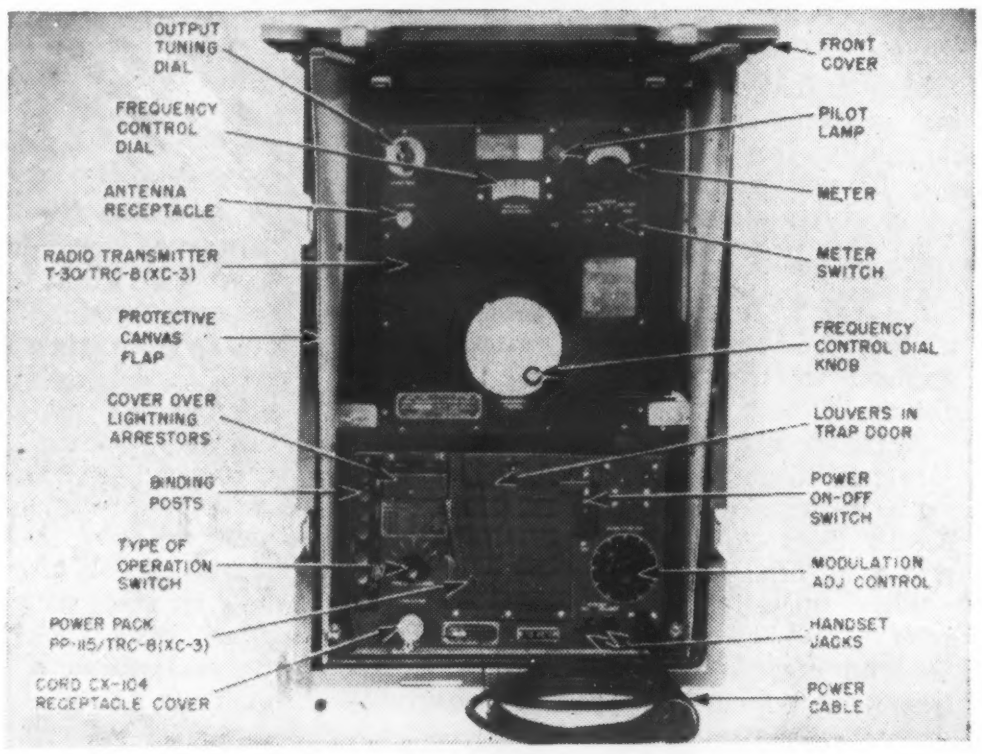
The major components of AN/TRC-8 are grouped in Figure 4. The transmitter is a resonant line oscillator operating at 1/3 the output frequency, followed by a tripler-power amplifier with an output of approximately 12 watts. It is reactance-tube modulated, and a maximum deviation of ∓ 100 kc. occurs at full modulation. The receiver is an 18-tube superheterodyne which also employs resonant-line tuned circuits. The judicious use of temperature-compensated condensers in the receiver, and appropriate combinations of Invar, steel and brass in the transmitter provides a frequency stability which is practically the equivalent of crystal control, with none of its disadvantages. The antenna system consists of a simple dipole radiator backed up by a corner reflector, an effective combination which provides a half-power beam width of about 85 degrees, and almost completely suppresses back radiation.

Available next were the pulse-time modulation radio-relay equipments. To trace their development, however, we must revert to the Fall of 1942 when the subject of radio-relay for military purposes was receiving concentrated attention. While efforts were directed mainly toward the development of VHF radio for use with available multi-channel carrier telephone equipment, considerable interest was shown in the micro-wave spectrum as a legitimate field for further experiments.

In September 1942 the first models of a then secret and unconventional multi-channel equipment developed by the British was inspected. Instead of a continuous carrier, the set emitted a series of extremely short pulses, and intelligence was conveyed by modulating the width of these pulses. Moreover, eight simultaneous intelligence channels were provided by means of a system of time-sharing known as time-division multiplex, which dispensed with the need for external channeling apparatus. The possibilities of the pulse system were evident and in January 1943 specifications were outlined for development of two such equipments for our use—both employing pulsed carriers and time division multiplex, but operating in

Fig. 4. Radio Receiver R-48/TRC-8 (left), and Transmitter T-30/TRC-8. Both are continuously tunable.





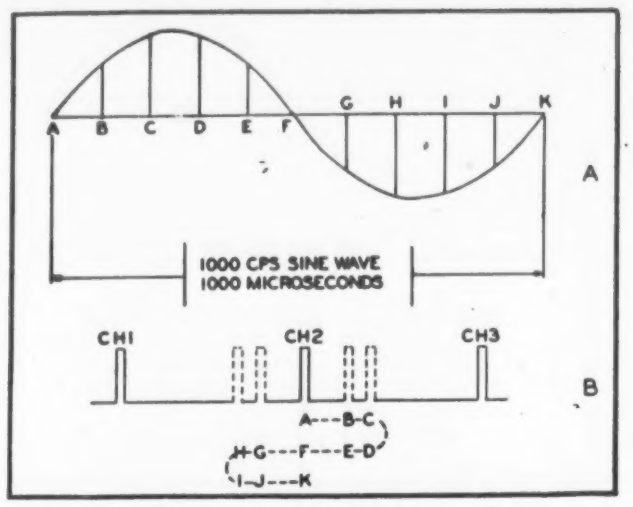


Fig. 5. Diagram of pulsed signal transmitted by AN/TRC-5.

different portions of the micro-wave spectrum—one at about 1500 mc., the other at approximately 4000 mc.

Multiplex

In a frequency-division multiplex system, the intelligence channels to be transmitted are "stacked" vertically in the audio frequency portion of the spectrum, usually by mixing each voice channel with a different fixed-frequency carrier, then suppressing the carrier and one of the two resulting sidebands. In the standard carrier terminal equipment used with the AN/TRC-1 series, for example, one voice channel, lying between about 200 and 2800 cycles, is transmitted without change, another is mixed with a carrier of about 6000 cycles and only the resulting lower sideband of 3200 to 5800 cycles is transmitted, the next channel is mixed with a 9 kc. carrier and the lower sideband of 6200 to 8800 cycles is selected. Thus, the output of the carrier equipment is a composite signal having frequencies of from 200 to about 12,000 cycles.

In time-division multiplex, each of the several channels to be transmitted is connected to the line in rapid sequence, and a minute sample of the instantaneous electrical condition of that channel is transmitted, interlaced with samples of all of the other channels. In the simplest case, each of the channels to be transmitted might be connected to separate segments on a stationary commutator or commutators, and these commutations "scanned" by a set of revolving brushes connected to the transmitting line. At the receiver, the interlaced samples might be separated using a duplicate of the transmitting device, rotating in exact synchronism with it.

Mechanical time-division multiplexing systems had been in use commercially for a number of years in the transmission of several telegraph or teletype signals over a single circuit, but prior to the development of electronic pulse-time modulation radio-relay equipment, these techniques had never been successfully applied to the multiplexing of voice channels.

Both of the pulse-time modulation sets mentioned employ essentially the same system of modulation. These are Radio Sets AN/TRC-5, on 1500 mc., and AN/TRC-6, 4500 mc.

The pulsed carrier generated in AN/TRC-5 is diagrammed in Figure 5. The signal consists of a 2 micro-second synchronizing pulse, the function of which will become apparent when we discuss the receiver, followed by eight individual four-tenth micro-second channel pulses. The first channel pulse occurs approximately six micro-seconds after the finish of the synchronizing pulse, and is followed at 11 micro-second intervals by the remaining seven channel pulses. Six micro-seconds after the eighth channel pulse, the synchronizing pulse recurs, and the cycle is repeated. The group of nine pulses constitutes a frame and occupies a 100 micro-second interval; hence, there are 10,000 frames transmitted per second, and, of course, each channel is sampled 10,000 times a second. The frame speed is determined by the highest audio frequency to be transmitted, as the audio signal can be regenerated at the receiver without appreciable distortion only if the sampling rate for each channel is at least three times the highest audio frequency transmitted.

In the unmodulated condition each channel pulse appears in the exact center of an eleven micro-second time interval allotted to that channel. Modulation in any of the eight channels varies the time of occurrence of that channel pulse a maximum of plus or minus four micro-seconds, depending upon the instantaneous amplitude and polarity of the modulating signal. As the time interval between adjacent channels is 11 micro-seconds, and the pulse deviates a maximum of four micro-seconds, there exists between adjacent channels a three micro-second "guard band" which prevents interchannel cross-talk resulting from excusions of a pulse into an adjacent channel.

Figure 6 shows in more detail just what happens to a pulse during modulation. Here is shown one complete cycle of a 1000 cycle sine wave—duration, 1000 micro-seconds. Assuming that a channel pulse occurs at exactly the beginning of the cycle, "A" in Figure 6, there is no amplitude, no polarity, and the pulse occurs in the center of its assigned time-channel. Successive pulses, recurring at 100 micro- second intervals, are displaced in time according to the instantaneous amplitude and polarity of the modulating signal at the time they occur.

At the receiver, the synchronizing pulse is separated from the channel pulses, and used to generate eight ten-micro-second "gates" in exact time sequence with the channel assignments at the transmitter. Each of these gates is conected to the input of a different channel demodulator and blocks that channel except during the expected time of arrival of a pulse for that channel. The position-modulated pulse trains for each channel are then converted to width-modulated pulses, from which the original waveform can be recovered quite simply by the use of appropriate low-pass filters. The position to width conversion is accomplished by means of a flip-flop miltivibrator, a familiar radar circuit, which conducts as soon as the channel gate "opens," and continues to conduct *until* the pulse arrives, when it is shut off. As the pulses may arrive at any time during the ten-micro-second gate, it can easily be seen that the pulses generated by the flip-flop circuit will vary from a fraction of micro-second in length when the pulse arrives several micro-seconds early, to almost ten micro-seconds when the pulse arrives several micro-seconds late.

Pulse-Modulated Units

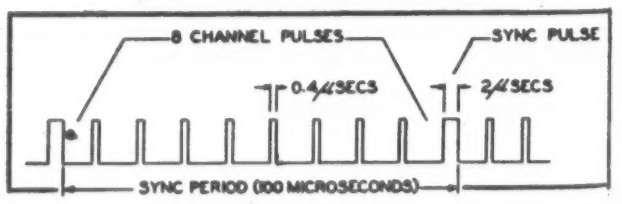
The difference between the AN/TRC-5 and /TRC-6 pulse-time modulation systems are minor. In TRC-6, the synchronizing pulse is four micro-seconds long, the channel pulses one micro-second, the frame repetition rate 8 kc. instead of 10 kc. and the pulse deviation is 7 micro-seconds rather than 5. In the receiver, the essential difference is that the flip-flop multivibrator is started by the arrival of the channel pulse and stopped by the closing of the channel gate.

In TRC-6 the transmitter and the receiver converter are mounted atop the 50 foot tower, immediately behind the parabolic reflectors in order to avoid the losses which would result if the 4500 mc. signals were "piped" from the antennas to the equipment at ground level. The video output of the multiplex frame is carried to the transmitter where it is amplified and keys a klystron oscillator. The receiver converter comprises a klystron beating oscillator, a crystal detector, and three stages of 60 mc. IF amplification.

In TRC-5 the lower frequency permits placing all components on the ground, feeding the RF signals to and from the antenna via low-loss coaxial cable. A notable feature of this set is the construction of the multiplex frame. All eight channel modulator units are exactly alike, as are all eight channel demodulators in the receiving section of the multiplex units. Each of these may be "tuned" in time to any one of the eight channels by means of potentiometers. Maintenance is considerably simplified by this type of construction, and the weight of the equipment is reduced appreciably as it is only necessary to carry a couple of spare modulator and demodulator chassis for replacement purposes, instead of a complete spare frame.

A number of advantages are afforded by the use of AN/TRC-5 and -6 equipment. The micro-wavelengths permit the design of extremely high gain, narrow beam antennas of the parabolic reflector type. Time-division multiplex has an inherently low level of interchannel crosstalk, the signal-to-noise ratio in the individual audio channels is excellent, and the audio distortion is negligible with properly designed circuits, so that the practical length of the system is limited more by cumulative effects of individual equipment failures rather than by distortion.

Fig. 6. Graphical analysis of modulated pulse time displacement.



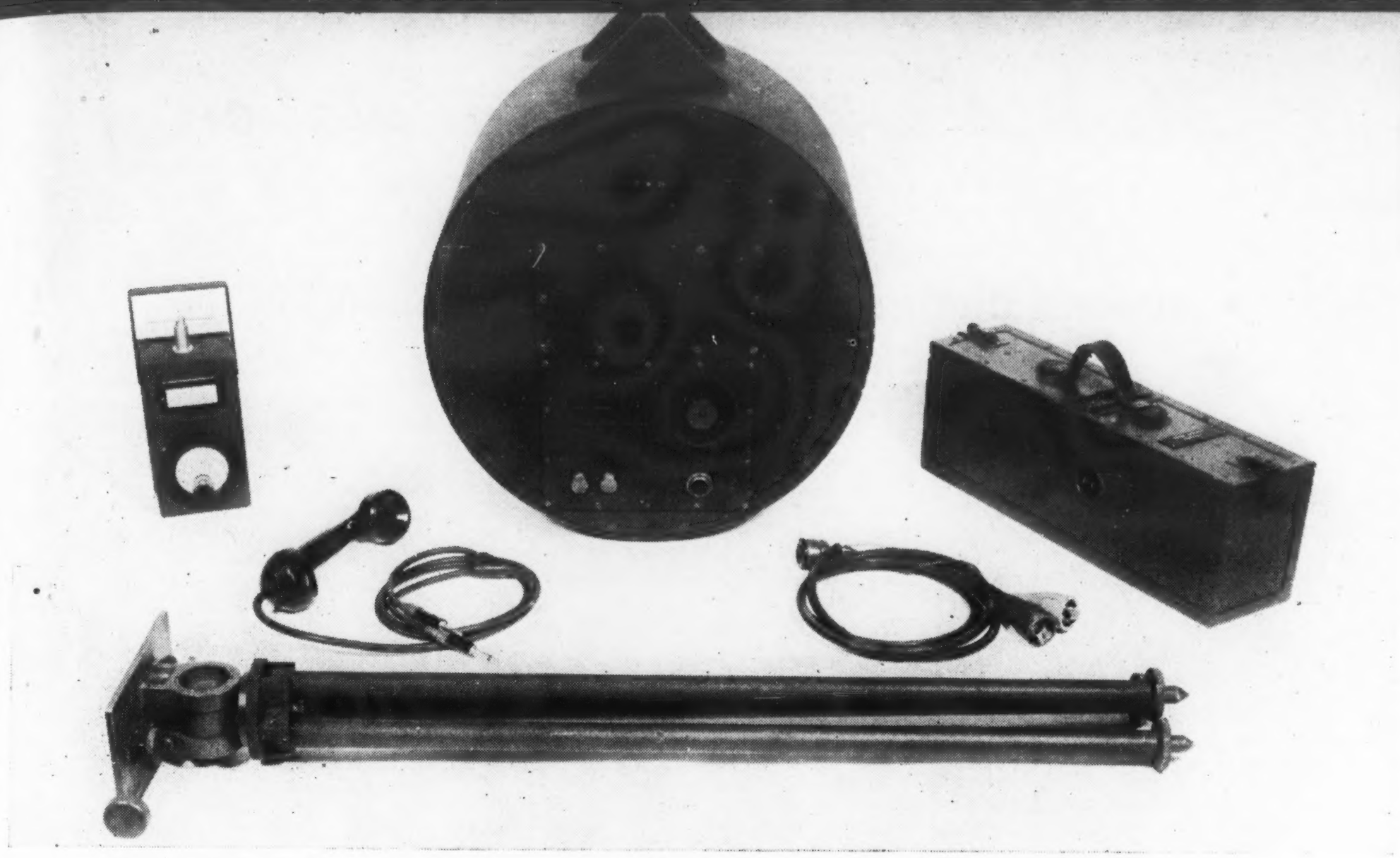


Fig. 7. Components of Radio Set AN/TRC-3. Left to right: wavemeter, transmitter-receiver, vibrator power supply. Antenna is contained in cylindrical case.

Other Systems

THERE ARE several methods of conveying intelligence other than by modulating the pulses in time: Pulse-amplitude, pulse-width, pulse-frequency and pulse-code. Pulse-code modulation is of particular interest in that satisfactory reception and demodulation of the signal depends primarily on the presence or absence of pulses, only secondarily on their shape and amplitude. In pulse-code modulation, the instantaneous sample of the amplitude and polarity of the modulating wave, instead of modulating the amplitude, duration or time-position of the pulse, is translated into a pre-arranged code of on-off pulses. Pulse-code might be compared with the five-unit teletype code, by which 32 different functions or operations may be transmitted. In a voice modulation system employing a five unit pulse-code, it would be possible to represent 32 separate conditions of the amplitude and polarity of the modulating wave. A six element code would permit sixty-four distinct levels, a seven unit code gives 128.

Still another related equipment is Radio Set AN/PRC-3, pictured in Figure 7. This set, operating at 2300 mc., is a short range, point-to-point communication unit, useful primarily in bridging rivers, gorges or short stretches of impassable terrain. The sets are novel in that they afford full duplex operation with one antenna, and contain a built-in hybrid circuit which permits connection to an ordinary two-wire telephone line, provided suitable voice-frequency ringing apparatus is provided elsewhere in the line. The operating frequency is somewhat above 2000 mc., the output power is about ½ watt and the effective distance range is up to 10 miles. Like most microwave equipment, resonant line circuits are employed.

All of these radio-relay equipments are designed with one primary objective: to provide a radio transmission facility which is the electrical equivalent of a wire line, so that wire and radio equipment can be combined into a single integrated communications system. Any radio set can be utilized as a link or extension in a wire system if design attention is given to certain technical considerations which facilitate such usage.

First, the radio transmission facility must be the equal of the wire circuit in terms of signal-to-noise ratio, and constancy of audio level, a requirement quite readily satisfied by the use of VHF equipment operated well within its dependable range.

Second, the audio systems of the radio receiver and transmitter must be matched to the wire circuits; input and output impedances of both radio and wire terminal and repeater apparatus must be compatible; a single standard of audio levels must be established; and the receiver and transmitter must be designed to work efficiently throughout the range of audio signal levels normally encountered in wire circuits.

Third, and perhaps most important from an operational standpoint, inclusion of the radio circuit as part of the wire system must not entail any changes in the normal function of the wire apparatus. In particular, the telephone subscriber must not be required to use one procedure when talking over a wire circuit, another with a radio-wire facility. The ordinary telephone is a duplex instrument, with the result that both parties may talk at will, whereas the normal field radio circuit is simplex; that is, the operator at one end transmits his message, then releases the circuit to the operator at the oposite end. Even if the telephone user could be educated to use the two fundamentally different operating procedures obtaining in simplex and duplex circuits, there would still remain the equipment problem, in that all telephone instruments would have to be equipped with "push-to-talk" switches, and all terminal and switching apparatus would have to be designed to pass the direct current necessary to switch a simplex circuit from one direction to the other. The logical solution is to design the radio set for duplex operation, which presupposes simultaneous operation of the radio receiver and transmitter without mutual interference, at least for the duration of a single conversation. It may be advisable to silence the radio transmitter during idle periods to conserve power or for other reasons, but once the subscriber's connection is completed, he should be able to use his telephone in the normal manner.

Fourth, in the absence of traffic the circuit must be quiet, whether the radio transmitter remains on or off, so that false indications are not received at the switchboard. The inclusion of a squelch circuit in the receiver will usually satisfy this requirement, and at the same time provide means for turning on an associated transmitter in a tandem relay system when a signal is received from the preceding station in the chain.

Finally, the fidelity of the radio system must be such that several sets may be used in tandem without serious degradation of audio quality.

Manila and the Capitulation

By Lt. Col. D. W. Eddy, Signal Corps

Communications for the Supreme Command in the Philippines and Beyond

As the Guinea war surged across the Owen Stanleys, bases were established at Oro Bay, at Lae and eventually at Finschafen. With the activation of an advance GHQ at Port Moresby a means of wire communication between these points became very desirable.

Radio teletype equipment was becoming available but radio operation over the Owen Stanley range was erratic and no means of reliable telephone communication could be provided. Accordingly the Allied forces agreed to jointly undertake the provision of wire communication over the mountains from Port Moresby to Dobodura and Oro Bay and thence northward to Lae and Finschafen. Although the entire project was formidable, the Owen Stanleys presented unusual difficulties. Special wire was manufactured in Australia for this portion of the route. This wire consisted of a single strand of #9 hard drawn copper, covered with a thick coat of synthetic insulation. Construction of the line was commenced simultaneously on both sides of the range and continued as far as possible by means of open wire leads. When it was no longer practicable to use open line construction, the special wire was employed. Poles were cut and erected on the spot, where feasible. Two wires were strung along the Kokoda Trail, attached to trees by means of special fixtures. Where possible, the two wires were attached an equal distance above the ground since employment of the physical circuit contemplated the application of "C" carrier.

Natives were used to a considerable extent in the construction of this section of line. They served as linemen and as bearers, since supplies and equipment had to be portered. Some of these natives became adept at stringing wire and making attachments to trees. Their ability to "walk up" trees was particularly useful. Eventually the line was completed over the range and Type "C" carrier was installed between Moresby and Dobodura with forty C1 VF telegraph carrier superimposed on one of the channels. Even though complete, constant maintenance was necessary to keep the line operative. Parties of Australian linemen were stationed along the route and made constant daily patrols, accompanied by natives. Considerable outage was experienced nevertheless. The line was well justified since it brought the various headquarters, airfields and bases into closer contact. With the extension to Oro Bay, Lae, Finschafen and up the Markham Valley, New Guinea was furnished with communication service far beyond its peacetime facilities.

Moving up from Brisbane, General MacArthur's headquarters settled high on the top of a hill a few miles by rough road from the few remaining vestiges of the settlement of Hollandia, in Dutch New Guinea. It was here that the Signal Corps one day received the word that a conference circuit would be required between Hollandia and Quebec in Canada, roughly 9,000 air-line miles distant. At that time the only Army radio circuit from the Southwest Pacific to the United States was one from Brisbane to San Francisco, using Western Electric single sideband equipment in conjunction with a Press Wireless 40 KW amplifier. A direct, radio teletype, frequency shift circuit was available, however, from Hollandia to Brisbane. Although the distance from Hollandia to Quebec by way of Brisbane was long and full of ionospheric hazards, on 14 September 1944 the conference circuit was established with excellent results. It was during this conference that the decision was made to alter plans and invade Leyte in the Philippines a month ahead of schedule.

Leyte

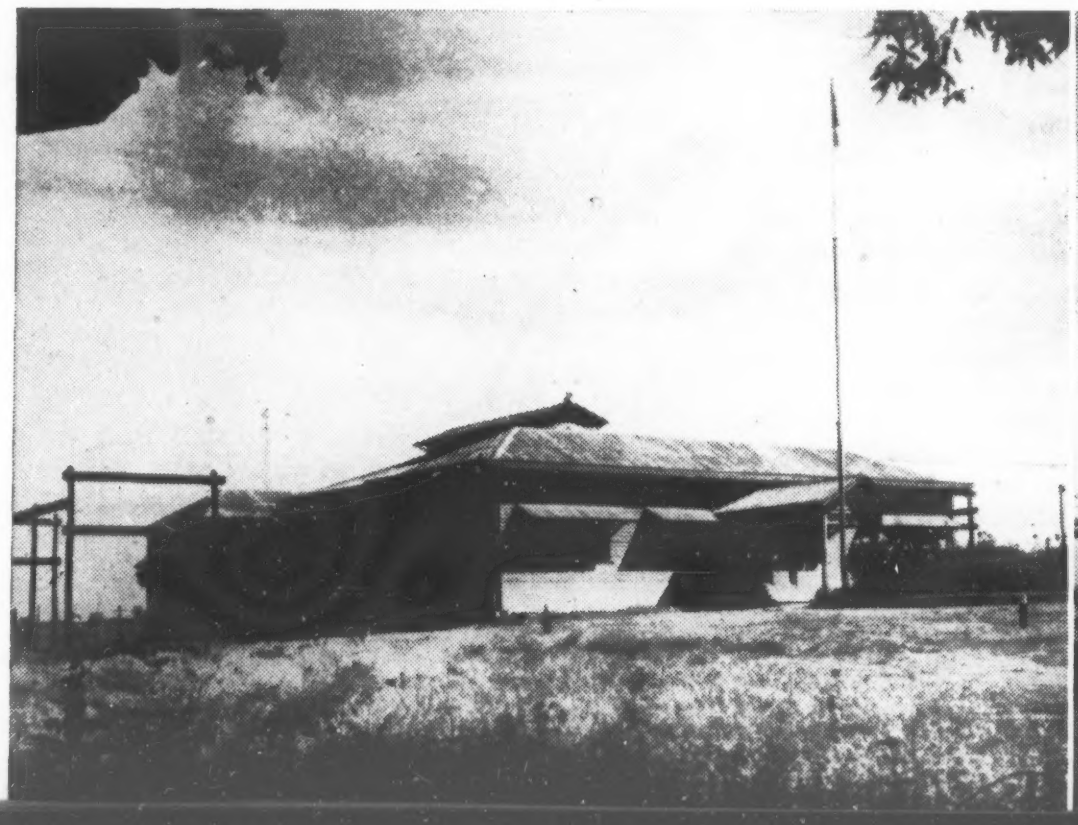
The plans for Signal communication for the Philippine invasion were necessarily more extensive and elaborate than any that had been previously executed in the theater.

This discussion of communications during the Leyte invasion will concern itself primarily with communication facilities for General MacArthur and his headquarters. This involved providing constant contact between the General and his headquarters in Hollandia as well as setting up the semi-permanent facilities for his staff in the Leyte area. In order to furnish communications on a complete scale, the Signal Corps set about providing personnel and equipment that could operate on the sea, as well as on land and yet be sufficiently mobile and flexible to cope with constantly changing tactical situations. This was accomplished by means of provisional detachments which later became known as the Mobile and Seaborne Communications Units.

Seaborne communications was not a new idea in the Pacific. During the operations around New Guinea the Signal Corps had employed boats to good advantage inasmuch as water was the principal means of transportation. For the most part these were small schooners fitted with manually keyed, medium power CW radio equipment plus small portable sets for ship-to-shore operation. Now, however, the Signal Corps branched out and utilized seaborne communications on a large scale.

The purpose of these floating signal centers was three-fold. First, to pro-

(Left) Transmitter building, Grace Park, Manila, November 1945. (Right) Interior of building.



vide communications during assault phases; second, during the period while fixed facilities were installed ashore; and third, to function as stand-by or emergency facilities in case of difficulty ashore. Five ocean going lighters had been equipped in Australia as communication ships and were used at Hollandia but they did not participate in the Leyte invasion.

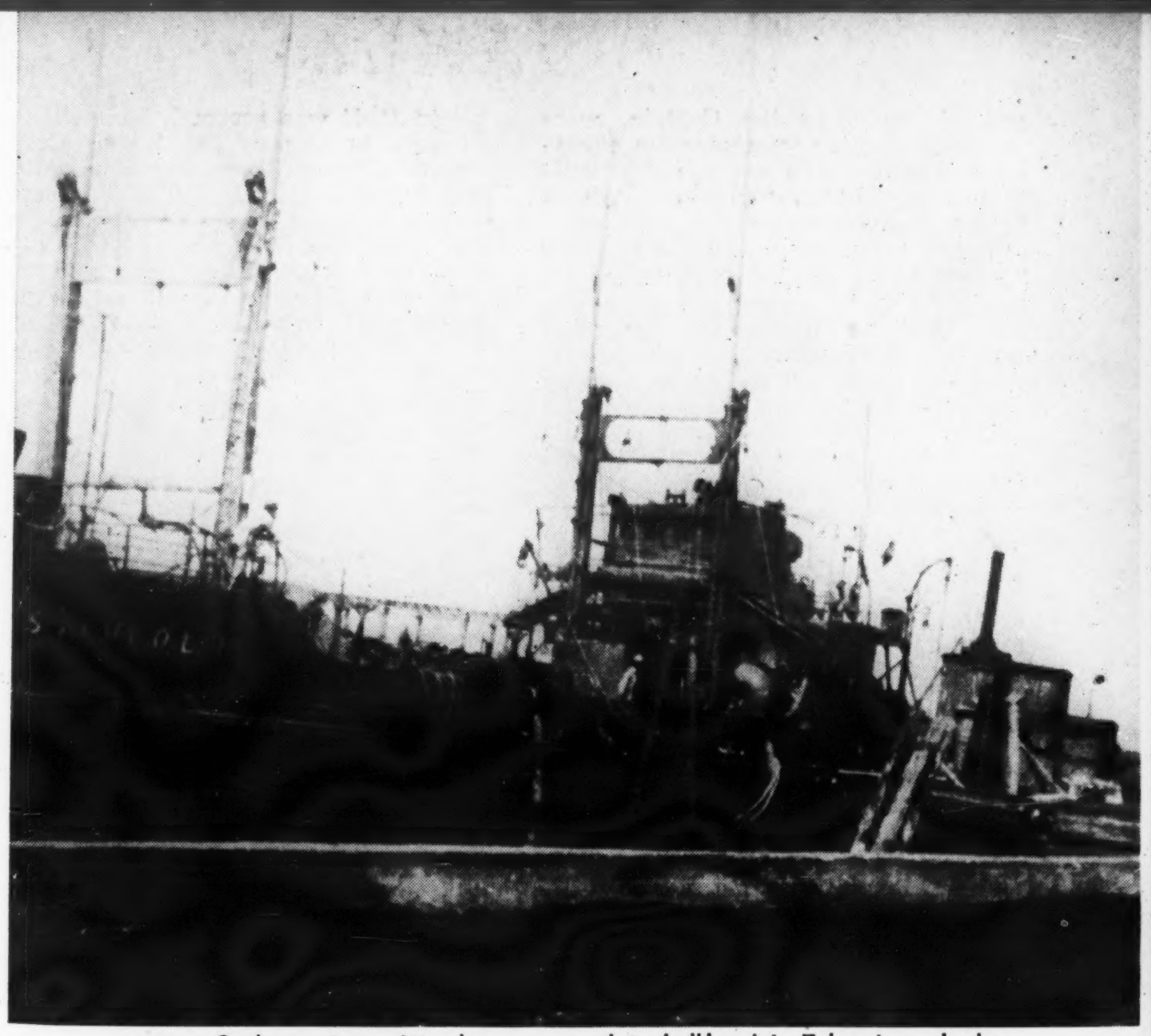
The Seaborne Signal Corps echelon, as utilized at Leyte, consisted of three Navy vessels known as Patrol Craft Escorts (Rescue), one former revenue cutter and private yacht, dating from about 1890 and one boat originally constructed for combination passenger and freight traffic in Alaskan waters. These boats were respectively the PCE's 848, 849 and 850, the "Apache" and "FP-47."

The three PCE's were designed as Navy rescue craft and consequently boasted oversize hospital space. This space was employed in fitting the ships with radio equipment. The vessels were equipped with two AT/20 transmitters, Australian sets rated at 500 watts. Receivers were a mixture of Navy-type shielded receivers, Super Pros and AMR 100's (Australian version of the HRO). The equipment installed enabled operation of 2 CW manual radio circuits from each ship and in addition provided extra receivers for intercept and monitoring. AN/TRC-3's with teletype and telephone channels were installed for ship-to-shore or ship-to-ship communications. In addition SCR-300's and 284's were placed on board for miscellaneous use as required. These small sets were frequently used for communication between ship and shore or reconnaissance parties and were invaluable in setting up initial contact. Necessary cryptographic equipment was included.

The "Apache" was intended as a broadcast ship and was equipped with a 10 KW Amalgamated Wireless of Australia broadcast transmitter. Power units were included and the transmitter was independent of the ship's generators. A modern broadcast studio with recording equipment and a control room completed the installation. This ship was also provided with VHF, telephone and teletype equipment, as well as SCR-300's and 284's.

The FP-47 was intended and employed as a Press Ship for use by war correspondents and although initially equipped for CW operation was later converted and high speed Boehme equipment replaced the original equipment. Australian manufactured AT/20 transmitters were also used on this vessel.

The Mobile Communication Unit was organized to work in conjunction with the Seaborne Unit, to provide easily established mobile communication facilities, in a minimum of time. It was also intended to serve on a temporary basis until such time as fixed semi-permanent facilities could be installed under suitable cover. The Unit as employed in the Leyte landings was somewhat smaller than that used in the Luzon operation but the type of equipment and service provided were similar.



Seaborne transmitter barge moored to bulkhead in Tokyo inner harbor.

The C-in-C

General MacArthur was transported to Leyte on board the cruiser USS "Nashville." Although communication silence was maintained during the voyage it was possible to get messages to the General, by Naval "Fox" broadcasts. A small detail of Signal Corps personnel accompanied the General and were provided with special cryptographic equipment for handling his traffic, as well as a Wilcox 96-C transmitter and VHF-carrier equipment. As soon as communication silence was lifted, communication by AN/TRC-1 and CW manual radio was established between the "Nashville" and vessels of the Signal Corps Seaborne Fleet.

"H" hour was at 1000 hours. At 1100 radio silence was lifted and the Seaborne Fleet commenced radio and VHF operations. The "Apache" sent out General MacArthur's communique which began with the words, "In a major amphibious operation we have seized the Eastern Coast of Leyte Island in the Philippines."

At H plus 4, or 1400 hours, a truck of the Mobile Communication Unit rolled ashore from a landing barge. This truck was equipped with a VHF radio terminal and miscellaneous equipment. Within fifteen minutes it had contacted the "Nashville" and the "Apache." Not long thereafter General MacArthur stepped ashore in his familiar gold braided cap, and after an inspection of the beachhead walked over to the communications truck and spoke into a waiting microphone the words that are now history—"I have returned. By the grace of Almighty God our forces stand again on Philippine soil—soil consecrated in the blood of our two peoples." These words were relayed to the "Nashville' and broadcast to the people of the Philippines and later were broadcast by both the "Apache" and the "Nashville" and by prearrangement were picked up by stations in California and Australia for rebroadcast throughout the world. The balance of Mobile Communication Unit, once ashore, proceeded to set up the communications for Advanced GHQ.

During this season rain dominated the Leyte work. Under the constant churning of heavy vehicles, the dirt roads of the island soon turned into masses of mud and water. This condition resulted in a slowing down of ground transportation and increased the use of the telephone systems. Construction of Signal facilities was a slow process and prior to the completion of permanent installations, the Luzon operation was under way.

Casualties

The Seaborne elements did not come through the landings unscathed. On October 25 (A-Day plus 5) four Jap bombers made one of many raids over Leyte Gulf. One of the PCE's was hit by fragments of a Japanese bomb; however, the bomber was shot down by the ship's gun crew and crashed a thousand yards off the port bow. The bomb fragments had pierced the first superstructure deck entering the Captain's cabin and the wardroom. Two of the ship's crew were killed and ten wounded, but no casualties were suffered by the Signal Corps complement. The ship was quickly cleared and was ready for further action just as the raid ended.

On October 28 (A-Day plus 8) another one of the PCE's ran into difficulty during an early morning raid. Three Jap 500-pound bombs straddled the ship, the nearest hitting only about 20 yards distant. A later count revealed that bomb fragments had put 80 holes in the starboard and 20 on the port side. Six men were killed

and 23, including the Captain, were wounded. Some communication equipment was damaged but the ship continued to operate until it was sent to a rear area for repair and refitting.

During its stay in Leyte the "Apache" originated daily a 30-minute broadcast to the Philippines known as the "Voice of Freedom." No effort was spared to insure that this broadcast was on schedule and as soon as possible a Wilcox 96-C transmitter was installed ashore to handle the broadcast when it became necessary for the "Apache" to displace forward and consequently resume radio silence.

The Mobile Unit had hardly settled in Tacloban when preparations were commenced to expand, re-equip and prepare it and the Seaborne elements for the Luzon operation while the Leyte installation was continuing. As rapidly as possible experienced personnel were replaced by men from the rear, trucks were overhauled, equipment was installed on vehicles and new personnel were given special training.

The Operation

By Christmas Day 1944, most of the major preparations for the Luzon invasion had been completed. On December 31st, the Mobile Unit commenced to load on LST's and other vessels. Portions of the Mobile Unit joined the Seaborne unit for the trip, in order to take part in the early phases of the landing. Still another portion of the Mobile Unit accompanied the assault troops in order to reach shore early in the landing.

The movement from Leyte to Lingayen Gulf was accomplished without damage to any of the Signal Corps vessels although there was some action by Japanese planes. The "Apache" experienced engine trouble and had to be towed a short way until it was discovered that there was water in the fuel supply. Fuel from the Signal Corps tanks on the ship was then used and the "Apache" arrived off Lingayen with the convoy.

As soon as communication silence was lifted the Seaborne Signal Corps Fleet went on the air and was soon working solidly with channels to Leyte and inter-boat circuits. The FP-47 operated a Boehme circuit back to Leyte where commercial press facilities were available to the United States. The "Apache" commenced its broadcast routine once again. Before many hours the news of the landings had been spread throughout the world.

On A-Day plus one the first trucks of the Mobile Unit drove ashore at White Beach, near the town of San Fabian. These vehicles were equipped with VHF terminals and were carrying SCR-300's for miscellaneous communication. Within an hour the trucks were in communication with elements of the Seaborne Unit and also with the cruiser "Boise," which had carried General MacArthur to the operation. The mission of this advanced communication detachment was to reconnoiter suitable sites for setting up the balance of the Mobile Unit, including selection of road approaches, to provide communications for General MacArthur and his staff.

Initially, it was decided to establish an advance GHQ echelon in the town of Dagupan. The remainder of the Mobile Unit came ashore on A pl one and A plus two. Due to dif culties with roads and bridges a go portion of the unit spent several nigh on the beach under Japanese fire wh critically needed trucks were mov into Dagupan on LCM's. A TC switchboard for General MacArthu headquarters was placed in operati from the truck, later replaced by TC/10. Contact with San Francisc using a 1 KW BC-339 CW transmitte was soon made and circuits were easi established for the short distance ba to Leyte and to other units in th area. The town of Dagupan was rel tively unharmed and a signal cent was established in an old two sto building across the market place. Wit in five days, a semi-permanent insta lation was in operation.

An interesting function of the Mo bile Unit was the so-called Intercep Section. This section, equipped wit radio receivers and cryptograph equipment, was utilized to intercep and decode traffic on pre-selected cir cuits of our own forces. After bein decoded and screened this traffic wa distributed to appropriate Staff sec tions in Advance GHQ. Through thi medium it was possible for staff offi cers to maintain a running and cur rent account of selected tactical units The Intercept Section had been initi ated in Port Moresby and was use throughout the northward advance. Fo operation with the Mobile Unit, it wa provided with a large six-ton van wit mounted receivers. The use of th vans was not practical in the Philip pines, however, because of road con ditions.

Elements of the 6th Army advance rapidly up the valley in the direction of Manila, and several VHF trucks leap-frogged with the advance, estab lishing contact with Dagupan from convenient locations along the high way.

Hardly had the town of San Miguel in Tarlac province, been cleared when 20 trucks of the Mobile Unit rolled into town and began to activate another communication center in an ticipation of the displacement of Ad vance GHQ from Dagupan. A rear echelon of the Mobile Unit continued to operate in Dagupan while the move was completed. Communications back to Dagupan were maintained by VHF and by CW radio with the Signal Corps boats that remained in Lingayen Gulf. These links were soon supplemented by spiral-four cable and by open wire strung along the right-of-way of the Manila Railroad Company. This railroad line had been constructed with concrete poles and as a result the majority of poles survived, although the wire was well cut up. The route of the railroad ran from Manila to San Fernado in La Union Province, just to the north of Lingayen Gulf. The Japs had done a thorough job of sabotaging the bridges and Signal Corps construction troops resorted to every trick in the book in order to push the wire along the track.

To supplement the electrical facilities and to provide for rapid transmission of mail and courier material, a motor and L/5 airplane courier service was inaugurated between San Miguel and Dagupan and vicinity. This project was operated under Signal Corps supervision, using Air Corps

General MacArthur arrives at Atsugi Airfield, Tokyo.

Destruction at Yokohama, Sept. 1945

planes. The Signal Corps had inaugurated an extensive service of this nature, using officer couriers, back to Port Moresby. By this time it extended from San Miguel to Brisbane by way of Leyte and points in New Guinea. Many thousands of miles were flown by these couriers in all kinds of weather and in spite of many harrowing experiences only one was killed in a plane crash.

Manila

Once again an advance element of the Mobile Unit bumped on towards Manila. Splitting into two sections, parts of the convoy joined elements of the 37th Division and the 1st Cavalry in the push to Manila. General MacArthur's desire to set up a headquarters in Manila was common knowledge and the Signal Corps was determined to be ready with communications. At 1300 hours on the 4th of February, personnel of the Unit pulled into Grace Park, a section on the outskirts of the city of Manila. Before many hours the unit had assembled in a shoe factory in the park. It is doubtful if any member of the unit slept that night. From a vantage point on the comparatively high roof of the factory an excellent view of the destruction of Manila was afforded. As Manila burned and erupted under shelling and sabotage many of the released American prisoners and internees were brought to the factory for shelter. Since no one could sleep in the excitement, a portable public address system was set up and music resounded through the building for the balance of the night.

When General MacArthur entered Manila and made a speech on the steps of Malacanan Palace, the "Capitol" of the Philippines, the Signal Corps was ready to put his broadcast on the air for the world to hear. The VHF link between Dagupan and San Miguel had been extended to Manila, as had the spiral-four cable. Two open-wire links along the railroad were also complete between Dagupan and San Miguel. In order to handle the broadcast it was necessary to use the transmitter on the "Apache", which, because of the condition of Manila Harbor, was still anchored in Lingayen Gulf, about 125 miles distant. When the General spoke into the microphone, his voice was carried from Manila to Dagupan by both wire and VHF radio link and thence by VHF link from shore to the "Apache." A mobile SCR-399 was parked in the palace grounds and the General's voice was also broadcast through this transmitter. Thus the "Apache" had a selection between three incoming signals for input to the 10 KW transmitter and the broadcast went through without a hitch despite technical difficulties involved.

As the position of the U. S. forces in the city was solidified and the stray Japs routed, the Mobile Unit commenced work on permanent communications for GHQ. Additional Signal troops entered the city and soon a large fixed plant installation was underway. The Seaborne elements eventually moved from Lingayen Gulf into Manila Harbor and swung to the tide. Civilization, even in the shambles of Manila, seemed good to everyone.

Communication facilities in Manila had been severely sabotaged by the Japanese and not very much of the pre-war plant remained. In some cases, however, it was possible to utilize city telephone exchanges after considerable maintenance and rehabilitation. During the early days of entry into the city a concerted drive was made to locate telephone company employees and these were soon put to work.

General MacArthur's staff eventually selected the City Hall as a main headquarters building and the Signal Center was placed in a nearby building previously occupied by the Municipal Water Company. Telephone facilities for the headquarters were first provided by a six position TC/10 Telephone Central Office Equipment. By the time that the headquarters reached its full size, a twenty position Kellogg multiple exchange had been installed, with the transmitters on the north side and the receivers on the south side of the city. Among other circuits a single side band to San Francisco and a multiplex to Hawaii were soon in operation.

Having been towed from Hollandia, another element of Signal Corps "Mariners" sailed past Corregidor into Manila Bay. This element consisted of six 120-foot, steel, ocean going lighters or barges and one wooden paddle wheel steamer. These lighters were the custom-built portion of the Seaborne Fleet. They had been made in Australia for cargo but had been acquired when new, by the Signal Corps, and outfitted for use as communication boats. The steamer, which

had previously plied in Australian coastal passenger traffic, 'was fitted as quarters for the men required to operate and maintain the communication equipment on the barges. Personnel, provided by the Transportation Corps, to maintain and handle the barges had quarters on board their individual craft. The lighters had been equipped to provide a large fixed plant radio installation complete with transmitter, receivers and a combination Tape Relay and Signal Center. All barges were equipped with AN/TRC-3 radio link equipment for communication between barges, as well as radio keying and control lines. Terminal frames were provided so that cable and wire links to other barges and to shore could be easily connected. Each barge contained two 50 KW diesel power units, modified with heat exchangers, for salt water cooling.

In Manila Harbor the boats were moored in two separate locations, one for the transmitter barges and the other for receiver barges. Although radio communications was possible, utilizing antennae erected on the barges, much better long distance communication was obtained with permanent shore antennae. Accordingly, rhombic antennae beamed on San Francisco were erected ashore for the single side-band circuit and as soon as they were complete, solid operation with San Francisco was attained. The completion of lead cable between the Seaborne transmitters and receivers and between the Seaborne receivers and the land based Signal Center provided a flexible arrangement for interconnection of facilities. When circumstances demanded expeditious establishment of a new circuit or when difficulty was experienced ashore, a telephone call and a few cross connections, on the right main frames, were all that was necessary to get another circuit on the air, or to provide temporary standby facilities.

On to Japan

As the situation in Manila stabilized, work and planning was commenced to prepare the Seaborne and Mobile units for the invasion of Kyushu and Honshu in the Japanese home islands. Selected personnel were relieved from their duty about Manila and new men were assembled and put in the Mobile Unit. A staging area was selected and the work of preparing for the invasion of Japan was underway, in earnest, about the first of July 1945. Elements of the Seaborne also commenced to make preparations and two ships participated in the landings on Borneo. The operation scheduled for the first part of November on the southern Japanese island of Kyushu was known as operation Olympic and promised to be a difficult one.

During the first weeks of August, a series of events changed the picture and Signal Corps activity in GHQ increased its tempo. The first of these events was the dropping of the atomic bomb on Hiroshima. Then, on 9 August, the Russians declared war on Japan and there was an urgent requirement to organize a communication detachment to provide communication from Siberia for a liaison group of General MacArthur's staff,

General MacArthur's headquarters, Dei Ichi Building, Tokyo.

scheduled for attachment to the Russion headquarters. This detachment received the highest priority for procuring clothing, equipment and supplies and in a remarkably short time was prepared to depart. Although the course of future events changed this plan, the organized and equipped detachment was soon put to good use.

It was about 0900 Manila time on the morning of 15 August that the final chain of events, which proved to be one of the most exciting and eventful of the war for the Signal Corps, commenced. In the Signal Center, located at the former Manila Water Works building, a routine teletype conference was taking place with "WAR," the teletype conference room, in the Pentagon, Washington. In the midst of the conference there was an interruption and Manila was advised to stand by to receive an important message. This message turned out to be the following: "NR 1408 WITH REFERENCE TO PARAGRAPH TWO OF WARX FOUR NINE ONE EIGHT TWO CMA PAREN FROM MARSHALL TO MACARTHUR CMA INFO NIMITZ DEANE AND WEDEMYRE PAREN YOU ARE HEREBY OFFICIALLY NOTIFIED OF JAPANESE CAPITULATION PD YOUR DIRECTIVE AS SUPREME COMMANDER FOR THE ALLIED POWERS IS EFFECTIVE WITH THE RECEIPT OF THIS MESSAGE."

In order for General MacArthur to carry out his duties as "SCAP" (Supreme Commander Allied Powers) it was obviously necessary that some sort of communication be established with Japan. As the first step toward this end Signal Intelligence selected the frequencies of an existing Japanese radio circuit. A 1 KW BC-339 transmitter was tuned to that frequency and a receiver was set up in the Signal Center. Fortunately, preparations for the invasion of Japan had advanced sufficiently so that rhombic antennae beamed in that direction were ready for connection. Operators capable of handling the Kana Kana and Romati alphabets were assigned to the circuit. The next problem was to get the Japanese to work the other end of the circuit. This proved to be rather difficult. General MacArthur's first message addressed to the Japanese Emperor, the Japanese Imperial Government and the Japanese Imperial Headquarters was delivered to the Signal Center for transmission before contact had been established. This message advised the Japanese authorities that General MacArthur had been appointed the Supreme Commander for the Allied Powers and that he had been empowered to deal directly with the Japanese concerning the cessation of hostilities. Included were details for inaugurating radio communication between Manila and any Japanese radio station in the Tokyo area.

Hours passed and the Japanese gave no indication of replying to our radio calls. When "WTA", Manila, broke into the Jap circuits the Jap operators would apparently stop and listen, exchange readability reports with each other, but would not reply. To at least annoy them further our transmitter was changed from 1 KW to 2-1/2 KW. Still no results! As alternative measures the AACS was asked to attempt to establish contact and a warship in Manila Bay to broadcast instructions, on the International distress frequency of 500 Kcs, for the Japs to come in and work "WTA" on 15965 kc.

Another message from General MacArthur to the Japanese was received in the Signal Center before the first had even been transmitted or contact established. The number of people waiting in the Signal Center was increasing and the atmosphere was tense.

To insure that no means of establishing contact would be neglected the Theater Chief Signal Officer called for a teletype conference circuit to Washington. When this circuit had been completed the Army Communications Service, in the Office of the Chief Signal Officer, was asked to utilize all its facilities in an attempt

Tape operations section of Manila relay station.

to establish contact with Japan. The first and second messages were furnished to Washington so that they could be transmitted, if possible. This resulted in communication stations all over the world calling Japan. While Manila was monitoring one of the Japanese stations, a Japanese operator was heard to acknowledge receipt of a message from RCA San Francisco. A frantic call on the single side-band voice channel to 'Frisco soon revealed the message receipted for had been General MacArthur's first message. In due time firm contact was established by Manila with station JNP and subsequently with JNU3, both in the Tokyo area. General MacArthur's second message was forwarded and instructions for maintaining radio contact were transmitted. There then followed an exchange of messages during which the arrangements were concluded for representatives of the Japanese Imperial Government and military forces, to fly to Manila and receive instructions regarding the surrender and the entry of United States and Allied forces into Japan. Once solid initial contact had been established, little difficulty was experienced in maintaining communications between Manila and Tokyo. A complete story of these events, "Surrender on the Air", is contained in the September-October issue of SIGNALS.

Movement to Tokyo

The problem of getting Signal Corps men and equipment to Japan now became of paramount importance and the Signal Corps swung into action on a "don't spare the horses" basis. First in line was communications coverage for the arrival of General MacArthur in Japan and the subsequent surrender ceremonies on the USS "Missouri" in Tokyo Bay.

On the morning of 18 August a Navy AGC "The Teton" set out for Okinawa to rendezvous with other vessels, and early entry into Tokyo Bay. An AGC is a Navy "command" vessel, completely equipped with communication facilities. On board was an operating complement of Signal Corps personnel and a quota of men ear-marked for early availability in Japan since the cargo vessels planned for transportation of GHQ signal equipment would not accommodate all the troops scheduled for movement. The PCE boats had departed earlier for Okinawa and there met the "Teton" for the trip to Tokyo Bay.

On 28 August, after dodging a hurricane for several days, the "Teton" and the PCE's arrived off Yokohama. The "Teton" established contact with San Francisco, and the PCE boats and with the "Missouri" and was available and ready to handle the large volume of press filed by correspondents in the area.

While the "Teton" and the other boats were wending their hurricane-fraught way toward Japan, another echelon of the Mobile Unit was also experiencing storm conditions at Okinawa. Two echelons, consisting of about 30 C54 planes loaded with men and equipment, had departed Manila on the 19th and flown to Okinawa. This group was equipped to establish radio teletype to Manila as well as local radio and landline circuits to ships in Tokyo Bay, other local headquarters, and internal telephone facilities for the temporary headquarters in the area. Two planes of this group arrived at Atsugi airfield, just outside of Yokohama at 0930 on the 30th of August a few minutes ahead of General MacArthur and his retinue. Through the use of commandeered Jap trucks the group moved into Yokohama where, by that evening, they had temporarily set up a CW radio net and were working the ships in the Bay.

The Customs House in Yokohama was selected as the temporary GHQ headquarters in Japan and on the morning of the 31st the small Signal Group, which was ashore, commenced to move in. Because the majority of the equipment was grounded on Okinawa, this group was limited to CW operation on one circuit and the majority of the heavy traffic load was handled by the "Teton" which had moved into nearby dock. By 4 September the balance of the equipment had arrived from Okinawa and a radio teletype circuit terminating in the Customs House was operating to Manila.

On 2 September the balance of personnel and equipment arrived from Manila occupying two AKA's, one APA and a portion of a Victory Ship. This group moved ashore and set about assembling equipment and preparing for the dash into Tokyo, which was still off-limits to Allied troops.

Tokyo was opened for occupation on the 8th of September. Prior to this date a few Signal Corps officers had visited the battered Japanese capital and had reconnoitered through the devastation and ruin in search of suitable sites for radio locations and to determine the state of the telephone plant. Sites in the Tokyo inner harbor were also inspected with a view to moving some of the Signal Corps fleet into proximity. The inner harbor of Tokyo is rather inadequate but after discussion with Japanese pilots and consultation of tide tables and charts it was decided initially to bring in one of the PCE boats.

The morning of the 8th was a busy one. Daylight found about 50 trucks of the Mobile Unit lined up and ready to roll for Tokyo at the drop of a hat. By 0900 this convoy was bumping, rather than rolling, over the much abused road between Yokohama and Tokyo. An advance detail had gone ahead prepared to guide and receive the convoy at destination. Another small group headed for the harbor to assist the PCE 849 to dock. This vessel was the first US Navy ship to enter Tokyo inner harbor and her crew had had many doubtful moments on the way when the fathometer showed just a few feet of water under her keel. An over enthusiastic Jap danced in greeting on the pier, bearing gifts of flowers and saki and had to be fished out of the water with a boat hook before the ship could dock.

By the morning of the 16th the elements in Tokyo were ready with radio teletype circuits to San Francisco and Manila, as well as land line teletype connections to Yokohama. The elements in Yokohama continued to function until the 17th when Advance GHQ opened in Tokyo and the Signal Center that had been prepared in Tokyo commenced to operate.

Consolidation

The building up of the facilities in Tokyo now became more or less routine. The Japanese offered no apparent resistance and a considerable number of Japanese technicians were hired to help overcome the ever present personnel problem, caused by the accelerated return to the United States of the experienced personnel that had been with the units since New Guinea. A considerable portion of the Tokyo outside telephone plant was ruined, in the bombing and firing of the city, but a good deal of it was still in repair and some portions of it were employed to advantage. Eventually GHQ was served by a Japanese automatic telephone exchange of 1500 lines which had been installed, with American equipment, before the war.

The GHQ radio transmitter and receiver sites were located on islands in Tokyo inner harbor and upon arrival of the Seaborne barges from Manila it was possible to moor them at the same islands making an extremely flexible and convenient arrangement. At one time a typhoon broke two of the barges loose but they were rescued in the nick of time and made fast once again. Eventually these barges were dismantled and the equipment installed ashore, or turned into Signal Depots.

This is but one version of communications in the Pacific. The story has not ended because General MacArthur still carries on in Japan. Nor has the story been a complete one in any sense. Hardly a word has been said about tactical communications in the Pacific. Little was included about the well known work of Signal Corps photographers, the constant problem of signal supply. The story of Signal Intelligence activities and units is highly interesting, especially in connection with guerrilla warfare in the Philippines. All of these contain stories within themselves and no doubt will one day be told in detail.

ASSOCIATION AFFAIRS

ARMY SIGNAL ASSOCIATION

OFFICERS

President, David Sarnoff
First Vice Pres., Wm. J. Halligan
Second Vice President, Darryl F. Zanuck
Third Vice President, A. W. Marriner
Executive Secretary and Treasurer
Brig. Gen. S. H. Sherrill, (Ret.)

DIRECTORS

Carroll O. Bickelhaupt
H. A. Ehle
Paul Galvin
Theodore Gary
T. H. A. Lewis
Dr. J. A. Stratton
William C. Henry
Dr. Lee DeForest
Dr. Frank B. Jewett
J. Harry LaBrum
Fred R. Lack
Chas. E. Saltzman
Leslie F. Muter
John J. Ott
Thomas A. Riviere
Dr. Harold A. Zahl
Col. F. W. Wozencraft, Counsel

New Officers and Directors

The Board of Directors announced on 29 April at Fort Monmouth that the following named were elected by letter ballots and action by the newly formed council to direct the affairs of ASA. Photos of fifteen of these officials are published on these pages, and pictures of the other six will appear in the July-August issue.

Officers: (Elected for two years)

President:

David Sarnoff, New York, President of Radio Corporation of America, served as a Reserve officer during the war and has received military and civilian citations for service, both overseas and in the United States.

Vice Presidents:

William J. Halligan, Illinois, President of Hallicrafters Company of Chicago, which produced large quantities of electronics equipment for the Army during the war.

Darryl F. Zanuck, California, Vice President, 20th Century Fox Film Corporation, served as a Reserve officer with the Army Pictorial Service during the war.

A. W. Marriner, New York, recently entered industry after having retired from the Regular Army after 28 years service in Air Communications with the Air Corps.

Directors: (Elected for two years)

Paul Galvin, Illinois, President, Galvin Manufacturing Corporation of Chicago, was one of the Army's important suppliers of radio communication equipment.

H. A. Ehle, Pennsylvania, Vice-President of International Resistance Company, Philadelphia, represents the component parts industry.

J. Harry LaBrum, Pennsylvania, a Reserve officer who served in important legal and supply positions, is a member of a prominent Philadelphia law firm.

Dr. Julius A. Stratton, Massachusetts, before the war, Asst. Professor at Massachusetts Institute of Technology; during the war, expert consultant in the office of the Secretary of War on radar developments, both air borne and ground for the Army Air Forces.

John J. Ott, Louisiana, retired Regular Army enlisted man, now with the Veterans Administration in New Orleans.

Dr. Harold A. Zahl, New Jersey, who is Assistant Director for Engineering Research, SCEL at Fort Monmouth, New Jersey, and served as an officer during the war.

(Elected for three years)

Carroll O. Bickelhaupt, New York, Vice President, American Telephone and Telegraph Company, New York, was a Reserve officer during the war and served as chief of the communications service in ETO.

Theodore Gary. Illinois, Vice President, Automatic Electric Company, Chicago, has rendered valuable manufacturing and consulting assistance on communications matters to the Army.

Thomas H. A. Lewis, California, Vice President in Charge of Radio for Young and Rubican, is a leader in the commercial radio field and served as Chief of the World-wide Armed Forces Radio Service of the Army, Navy and Air Forces during the war.

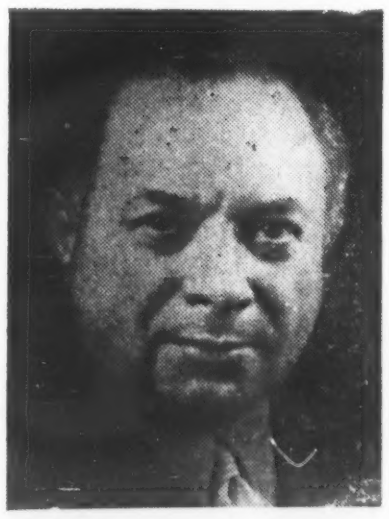
Thomas A. Riviere, District of Columbia, who served as an enlisted man during the war and was in charge of setting up communications for the Quebec, Yalta and Potsdam Conferences, is now a civilian employee of the War Department in Washington.

Dr. Lee DeForest, Chicago, pioneer radio scientist and inventor whose name is known in radio the world over.

(Elected for four years)

William C. Henry, Ohio, President, Northern Ohio Telephone Company, served as a Reserve officer with the Signal Section SHAEF during the war.

Brig. Gen. David Sarnoff
President

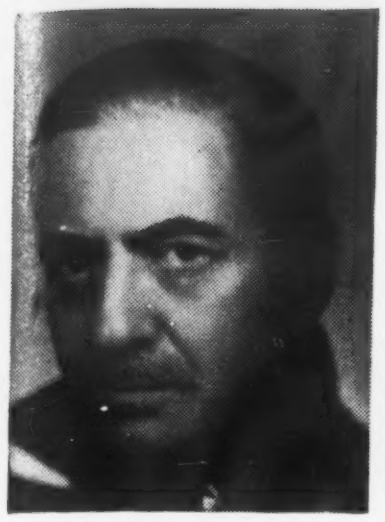


W. J. Halligan
Vice-President

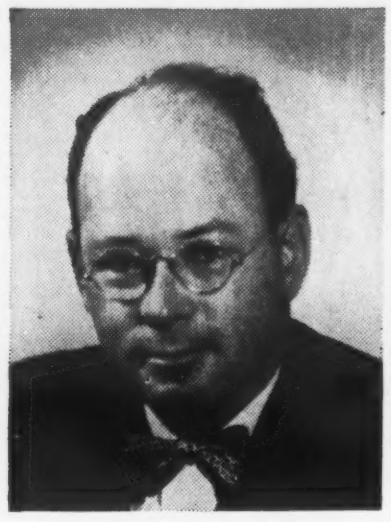
Col. Darryl F. Zanuck
Vice-President

Brig. Gen. A. W. Marriner
Vice-President

Brig. Gen. S. H. Sherrill
Secretary-Treasurer



Brig. Gen. C. O. Bickelhaupt
Director



Harry A Ehle
Director

T. S. Gary
Director

Col. J. H. LaBrum
Director

F. R. Lack
Director

Dr. Frank B. Jewett, New Jersey, is known throughout the world as an inventor, scientist and engineer.

Fred R. Lack, New York, Vice President and Director of Radio Division, Western Electric Company in New York, was director of the Army-Navy Electronics Production Agency during the war.

Leslie F. Muter, Illinois, President, the Muter Company, represents the coil industry and took an active part in solving the coil problem during the war.

Charles E. Saltzman, New York, long associated with the National Guard in New York, with a distinguished record as an officer in the Army during the World War II, culminating in the award of the DSM. He is the son of a former Chief Signal Officer.

Counsel:

Frank W. Wozencraft, Dallas, Texas, served with the Signal Corps as communication Secretary, Joint Chiefs of Staff. He is now practicing law in Washington, D. C.

Executive Sercretary and Treasurer

S. H. Sherrill, Brig. Gen., U. S. A. (Ret.), wartime commander of Camp Kohler, California; Drew Field, Florida, Radar Training Center; and Fort Monmouth, New Jersey.

Contest Winners

One of the most energetic persons in ASA is Captain Harry E. Fisher, Secretary of the Washington Chapter and formerly Captain in the Signal Corps. Through his efforts on behalf of ASA Captain Fisher received the Life Award, which is first prize in the Association Membership Contest announced in the January-February SIGNALS.

Captain Fisher has traveled extensively throughout the Second Army Area to assist in forming Chapters, particularly in Philadelphia, Baltimore and Richmond. However, most of his work has been concerned with increasing the Washington Chapter membership and planning many of their outstanding affairs this year.

Second prize goes to Lieutenant Colonel E. T. Maben of Richmond, who has so industriously worked these past months in getting members for the newly formed Richmond Chapter.

A new Contest will begin on 1 July 1947. There are less than 4,000 membership to get of the 10,000 goal. All entrants should notify the Circulation Department by then.

CHAPTER NEWS

Richmond

On 20 March Richmond Chapter held its "formation" meeting at Hotel John Marshall, where former members of the armed forces, especially the Navy, entered into the discussion of plans for expansion. The following officers were elected: A. L. Lambdin, Vice President of the Chesapeake and Potomac Telephone Company, President; Lieutenant Colonel E. T. Maben, First Vice President; Sanford T. Terry, Jr., Second Vice President; and Miss Jean Melton, a former member of the Waves, Secretary-Treasurer.

Among the speakers were Mr. Lambdin and Brigadier General S. H. Sherrill, who spoke on the aims and purposes of ASA.

Colonel Harry Reichelderfer, former Signal Officer of the Sixth Army in the Pacific and now of AGF, presented the Richmond Chapter with its Charter 6 May, making it the first chapter in the southern part of the United States.

Baltimore

Into the ever growing Chapter fold of ASA came the Baltimore Chapter 6 May. They have been steadily working on memberships for some time prior to their forming a Chapter. Officers are John R. Shea, President; Hope Barrall, First Vice President; F. E. Moran, Second Vice President; and Colonel H. G. Miller, Secretary-Treasurer.

Ogden-Salt Lake

Last March the Ogden-Salt Lake Chapter was granted its Charter, and the following officers were announced: Don G. Moore, President; Kenneth C. Reid, First Vice President; Earland Ohman, Second Vice President; and Marjorie R. Hansen, Secretary-Treasurer.

Texas Tech

Deep in the south-west section Texas Tech Chapter held a smoker in the Pine Room of Hotel Lubbock, at which time the following officers were elected: J. P. Lilly, President; James F. Johnson, First Vice President; T. C. Root, Jr., Second Vice President; Rush D. Robinett, Secretary; T. F. Timmons, Secretary; J. W. Stewart, Assistant Treasurer; and Major John M. Goodman, Sponsor.

MAJOR GENERAL HARRY C. INGLES ELECTED PRESIDENT AND DIRECTOR OF RCA INSTITUTES, INC.

Major General Harry C. Ingles, who served as Chief Signal Officer of the United States Army from July, 1943, to March, 1947, has been elected President and a Director of RCA Institutes, Inc., it was announced recently by David Sarnoff, President of Radio Corporation of America. The appointment is effective immediately.

Brig. Gen. Charles E. Saltzman
Director

Leslie F. Muter
Director

T. A. Riviere
Director

Dr. H. A. Zahl
Director

Col. F. W. Wozencraft
Counsel

UHF tetrode

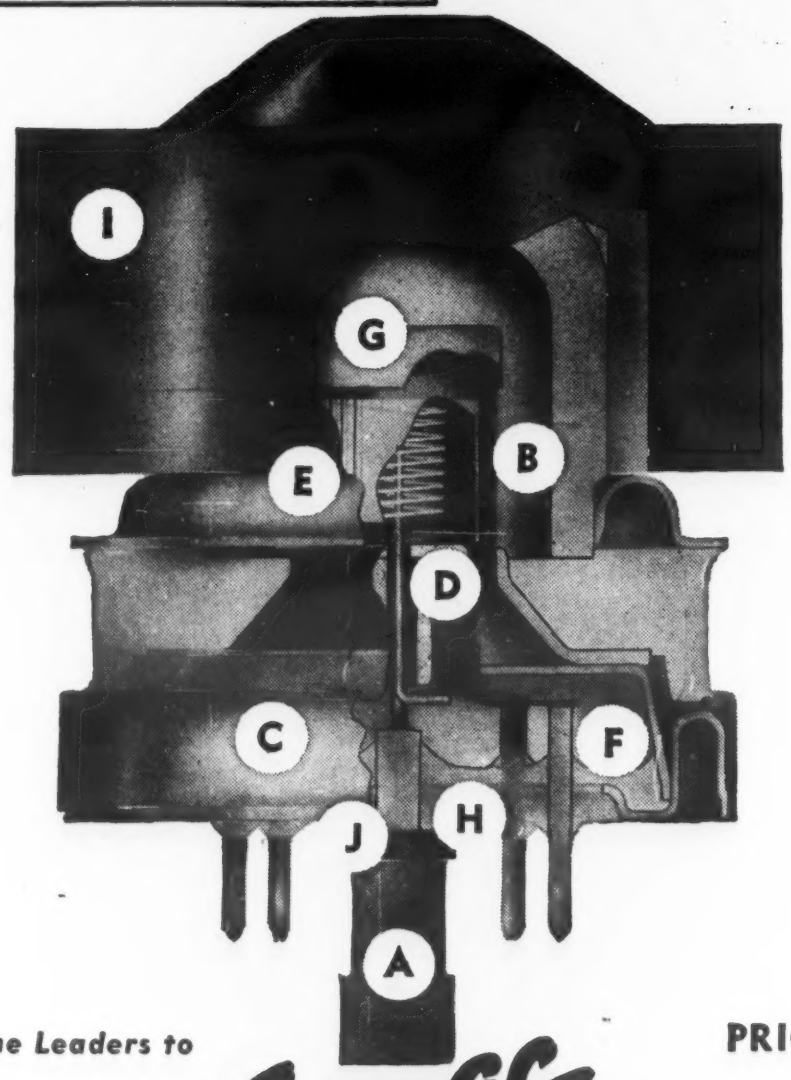
Eimac 4X150A Power Tetrode

Electrical Characteristics

Heater voltage	6.0	volts
Heater Current	2.7	amps.
Grid-screen amplification factor (approximate)	4.	
Direct interelectrode capacitance (typical)		
Grid-Plate	0.02	µµf
Input	12.0	µµf
Output	4.6	µµf

Maximum Ratings

DC Plate voltage	1000	volts
DC Plate current	200	ma.
Plate dissipation	150	watts
DC Screen voltage	300	volts



The 4X150A, a new Eimac tetrode, extremely versatile—diminutive in size, will fill the bill in all types of application and at all frequencies up to 500 mc. Performance characteristics include — high transconductance, low plate voltage operation, low grid drive, high plate dissipation, and traditional Eimac-tetrode-stability. Physical features include:

A Low inductance grid lead.

B Close element spacing for UHF and high transconductance.

C Screen grid, mounting, and ring connector design effectively isolates input and output circuits.

D Heater isolated from cathode.

E Indirectly heated cathode.

F Low inductance cathode terminals, (four separate paralleled pins).

G Controlled primary and secondary grid emission, by specially processed grids.

H New molded glass header, precision pin alignment.

I Forced air cooled (vertical finned).

J Simple installation, adaptable to standard loctal socket.

You will find the 4X150A suited to your requirements, whether for wide-band low-efficiency service such as television video and audio or conventional application. For further information on this new, versatile, Eimac tetrode, type 4X150A write to:

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The Power for R-F

EXPORT AGENTS: FRAZAR & HANSEN, 301 CLAY ST., SAN FRANCISCO 11, CALIFORNIA, U.S.A.

ANNUAL REPORT

BY THE BOARD OF DIRECTORS TO THE MEMBERS OF THE ARMY SIGNAL ASSOCIATION FOR THE YEAR ENDING 30 APRIL 1947

1. INTRODUCTION

This report for the first year of existence of ASA records the initial efforts to organize the Association, to circularize prospective members, and to establish a National Headquarters. It records the growth from May 1, 1946, when it may be considered that definite decision to organize was made, until the first annual convention held at Fort Monmouth, New Jersey. This report was prepared by the Executive Secretary in compliance with Paragraph 11 of the interim By-laws.

2. PRE-ORGANIZATION ACTIVITIES

The fact that the communications and photographic personnel of the armed forces had no association and no journal as most other combat and technical branches had for many years, was considered by many as a serious obstacle to success in these fields. In Washington the Chief Signal Officer, Major General H. C. Ingles, had several discussions during 1945 with the Air Force, Navy, War Department officials, and industrial leaders about the matter. The then Commanding General at Fort Monmouth at the same time was discussing the matter with several of his staff and commanders and considering recommendations from them. Similar discussions were being carried on elsewhere—especially in certain overseas theaters. It was generally agreed that an association was needed. When Brigadier General S. H. Sherrill was placed on the retired list in January 1946, he came to Washington, discussed the matter again with the Chief Signal Officer and before the end of the month submitted a memo on the matter with recommendations covering initial steps to be taken. Detailed studies and surveys of all the other military associations were then made by him, an interim constitution drawn up, interim officers and directors to represent every category of personnel concerned with such an undertaking were chosen and asked to serve, arrangements for a temporary office were made and General Sherrill was asked "to proceed at once as Exectuive Secretary with the organization of such an association." On May 1, 1946 Major General H. C. Ingles sent a letter to individuals whom he considered interested in the formation of the Association, thus marking May 1, 1946 as the date of formation of ASA. . . .

3. INITIAL STEPS

. . . Correspondence was coming to the Office of the Chief Signal Officer where it was processed by the Executive Officer, Lt. Colonel James W. Baldwin who started the first set of books on his own time in the evenings. No one did more than Colonel Baldwin to launch ASA. The first membership recorded was that of Major General H. C. Ingles on May 20, 1946.

4. EXECUTIVE COMMITTEE MEETS

The Executive Secretary arranged for the first meeting of the Executive Committee, as prescribed by the Constitution, to be held in New York in June within a month from the date of the first official entry in the books. Those present for this meeting in General Sarnoff's offices in Rockefeller Center were: General Sarnoff, President; Fred Friendly. Vice President; Colonel George P. Dixon. Fred R. Lack, Directors; and General S. H. Sherrill, Executive Secretary. Subsequent monthly meetings were held in New York, Washington and Chicago. the annual meeting of the Board of Directors being held at Chicago January 20, 1947. Since the Chicago meeting. the Executive Committee meets quarterly rather than monthly.

5. PUBLISHING PROBLEMS

Shortage of paper, labor difficulties and other conditions made the several publishing houses hesitant to bid on our proposal to print the bimonthly magazine named SIGNALS and the monthly SIGNAL BULLETIN. Bids finally were secured and the order placed with the low bidder, Telegraph Press of Harrisburg. It was impossible to secure the high grade of paper desired for the magazine, however. A change was made in December in the method of producing the Bulletin, the much less expensive offset method being adopted at a very substantial saving. There has been an abundance of timely and suitable material for publication. Fortunately, it has been unnecessary to offer "author's fees" as is done by some of the service journals to induce contributors to prepare and submit articles. As soon as our financial situation permits, however, it is proposed to offer a modest fee to uncover material in a continuing flow for future issues.

6. PAID ADVERTISING

Considering the fact that the other service journals reported a substantial reduction in the amount of advertising they were able to sell during the days of readjustment for industry after World War II, we were fortunate through the loyal support of certain of our group members in being able to place a few pages of advertising in SIGNALS since the first issue in September. It has not, so far, been possible to sell the 19 pages set aside for advertising. Better results are hoped for under the contract entered into in March with Frank J. McNally of New York, on a commission basis—the procedure followed by the other journals. Until then we had been doing all the selling of advertising by direct personal contacts.

7. MEMBERSHIPS AND CIRCULATION

. . . Memberships by month follows:

Month	Total	Full	Student	Life	Group	Subscription
May	494	314	14	10	26	
June	1092	890	41	11	25	
July	1217	887	18	12	50	
August	1227	1078	52	7	13	12
September	549	450	41	2	6	20
October	448	341	54		6	17
November	378	294	32	3	6	13
December	255	204	37	2	1	7
January	262	224	20		3	2
February	206	152	16	6		32
March	308	255	21	8	2	13
April 15	144	129	11	1		3
Total April 15	6580	5218	357	62	138	119

This compares with a total of 8,000 in the Society of American Military Engineers after *10 years* of existence and 3.386 in Army Ordnance Association after *9 years* and is, therefore, considered satisfactory for the first year. Our target for the second year is 10,000 full and student members and 200 subscribers to the magazine. . . .

8. HEADQUARTERS ORGANIZATION

The organization now in effect since the reorganization in January is as follows:

Executive Secretary
- Editor
- Business Manager
- Treasurer

Publications Division
- Assistant Editor
- Circulation Dept.
  - Manager
  - Assistant
- Editorial Dept.

Administrative Division
- Office Manager
- Accounting Dept.
- Book Sales Dept.
- Extensions & Services
- Secretary

Including the Executive Secretary there are at present six employees, one of whom is employed only half time. Civil Service rules are followed. . . .

9. FUTURE OF ASA UNDER THE "MERGER"

Since the Association now serves both the Army and the Air Forces and our group and other members produce equipment for both, there is no change contemplated except in the name of the Association if "unification" legislation is passed. We intend to extend our assistance then in military preparedness matters to all military communications and photographic activities of both services and the Navy as well if that service wishes to support the Association and receive assistance from it.

10. CHAPTERS

Limited funds during the first year curtailed travel by the Executive Secretary to far off places to organize chapters. The need for constant supervision of the newly established Headquarters made it inadvisable to be absent from Washington for more than a day or two at a time. It is expected that conditions will permit more extensive travel during the coming year. Even so, the formation of thirteen chapters is satisfactory when one considers that nine years after it was formed Army Ordnance Association only had eleven chapters. Much remains to be done in improving chapter activities. . . .

11. OFFICES AND EQUIPMENT

In addition to the office space loaned and then rented initially from Coast Artillery Association, desks, typewriters and office equipment had to be procured. Some were rented or borrowed as the articles were not available for purchase anywhere in Washington and when some were located prices were excessive. From the very beginning our needs were

listed with WAA without, however, being fulfilled even yet, except for a few pieces of furniture. The offices are now completely furnished with articles mostly procured in the open market. Office space itself was not at first to be had in Washington. When suitable space was finally found the rentals were exorbitant and more than the Association could afford. The present offices while entirely too expensive for a second rate building are well located and are satisfactory as long as the headquarters staff does not exceed the present six.

12. COMMITTEE FOR COORDINATING MILITARY ASSOCIATIONS

Early in the summer it was decided among the Executive Secretaries of the several military associations that a central coordinating committee should be formed and meet once a month at the Army-Navy Club for the purposes of increasing the effectiveness of the several associations and planning joint action projects. The first annual meeting of the members of all associations sponsored by the committee was held in the Stevens Hotel in Chicago on January 20, 1947. Over 1,500 members heard General Eisenhower deliver a stirring address at the banquet after General Collins and others had addressed the members in the afternoon and special meetings had been held by each association at which progress reports were made to their members. The Chicago Chapter, ASA, sponsored our participation and prepared all the plans. Member associations are: Air Force, Chemical Warfare, Engineer, Infantry, Ordnance, Signal, Surgeon, Transportation, Quartermaster. Because active duty personnel are on their staffs the Cavalry, Field Artillery and Coast Artillery Associations do not belong.

13. EMBLEM

An official emblem (or insignia) was adopted in the fall. It was designed by one of our life members, Captain B. H. Christenson, who supervised art work in SCPA at Fort Monmouth during the war. It is a beautiful piece of work, the elements of the design being highly appropriate in their significance to ASA and form an emblem of beauty and distinction.

15. FINANCIAL

Much study of this problem was necessary before a decision could be reached as to the method to follow in the initial financing. Methods considered included borrowing $50,000, canvassing certain individuals for loans of $500 to $1,000 without interest, and large industrial concerns for similar loans of $5,000. There is no question but that either of these methods would have succeeded and would have made immediately available to the Executive Secretary funds to enable him to rent and furnish suitable offices and otherwise to proceed with more facility in the initial organizational work. It was decided, however, to operate on a "pay as you go" plan. The budget for the first year's operations was established at:

Salaries	$15,200
Rent and Office expenses	5,000
Publications	30,000
Travel	1,000
Total	$51,200

We do not intend to accumulate a large reserve although a certain amount is an essential to make provision for a "rainy day" such as the other associations have all had. As soon as funds become available we propose to grant money to chapters, as provided in Paragraph 23 of the By-laws, publish the magazine every month, pay our authors and print a large magazine with illustrations in color, among other things. But with the current rise in prices for paper, for printing, for salaries and all other essentials it seems more likely that we may have to increase our dues as many of the other associations and most national magazines already have done. This will be avoided if at all possible as it would decrease our membership which we must not permit. . . . The accounts of the Association were audited in January, at the conclusion of the first six months, by one of the largest of Washington's independent firms of commercial auditors. This was expensive and it is expected that a less expensive procedure to audit the accounts will be employed after the first year.

17. ADOPTION OF CONSTITUTION

The members have voted on the adoption of a Constitution for our Association to replace the interim Constitution now in effect which was drawn up a year ago. It was decided to appoint a committee of five to draw up a Constitution and By-laws and then to submit the draft for approval, as is provided by the interim Constitution for adoption of amendments to that document. An exhaustive study was made of the Constitutions of other military and similar associations and the best and most appropriate features of them were incorporated in our draft by the committee of five. The legal advice of our Counsel and others experienced in the interpretation of provisions of Constitutions was secured. The result is the Constitution which is printed in March SIGNALS. The vote indicates the great majority of the voters favor adoption of the Constitution as printed. . . .

18. CONCLUSION

With each war in which we are engaged communications become increasingly important. Already, brilliant traditions and records have been made by those individuals who devote themselves to military communications and photographic work. Regardless of the shape and form of new weapons and techniques no function of our Armed Forces faces a more challenging future. We have felt the need of a professional association like ASA for many years, especially immediately before and during World War II. Our objectives appear almost limitless in their possibilities—all adding up to objectives that will contribute to the good of our country. Military strength in this era of total war means more than trained fighting men—it includes industrial readiness and economic strength. World War II taught that war requires technological resourcefulness which means our military leaders must consider *now* every field of knowledge—politics, history, science. This Association and those of the other branches of the Armed Forces have as one of their most important reasons for existence continued improvement in civilian-military coordination to insure the most effective use of manpower, productive capacity and the evaluation of priorities.

This first year has necessarily been devoted almost entirely to organization work. It can be said now that this is finished so that in the coming year and thereafter the attention of National Headquarters can be devoted to the initiation of projects that will result in real contributions to military preparedness. The extent to which this can be done will depend largely on the number of renewals. These projects will take the form of activities by our National Advisory Committees to a considerable extent. Army-Navy Munitions Board has stated they will call on us for recommendations. How shall we select the best men for these committees? That will have to be decided. Another thing that we mean to get well launched in the coming year is a program to keep our military members—especially National Guard and Organized Reserve—sufficiently appraised of current development of importance to them. In this field members from those components and active duty officers serving with them will have opportunity to help the Association by submitting information and manuscripts of interest to them and doing much to promote better understanding between the Regular and civilian components of the services.

It is planned also to introduce certain awards for which our members may compete. Among these would be—

a. An annual gold medal to the member who renders the most conspicuous and meritorious service to the Association during the calendar year preceding the annual meeting.

b. A silver medal to the author of the best article published in SIGNALS during the calendar year.

c. ROTC trophies.

d. Scholarships.

e. Awards to members who enroll a specified number of new members. A committee to study this proposal will be designated.

Having successfully passed through the first and most difficult year of its existence our members may look forward to assured success in carrying out ASA's objectives of assisting to ensure National Security through military preparedness.

For the Board of Directors
S. H. SHERRILL
Brig. Gen., U.S.A. (Ret.)
Executive Secretary

MOVIES FOR CHAPTER MEETINGS

ASA members will be interested to know that when motion picture "Oscars" were handed out a few weeks ago in Hollywood, the Signal Corps' Pictorial Service received one too. It was for producing the best documentary film of the year, "Seeds of Destiny," a truly great film. It shows how the seeds of the future are being planted at this very moment in the children of Europe. With care, food and education they can become instruments of good, of peace, of a better world. It takes 20 minutes to show it. Ask for it for your next chapter meeting. The Signal Officer of your Army Area can get it for you.

The Official Pictorial History of the AAF

Military Aviator Badge

The first Army "Wings" awarded by Signal Corps, 1912

The first complete record of the development of Army air power from the early experiments of the Signal Corps with the Wright Flyer in 1909 to the giant Superfortress of today.

600 dramatic photos, 25 full-color drawings, and a complete catalogue of military planes.

Carl Spaatz, Commanding General, AAF, says of this important military book: "This graphic presentation will quicken the pride of every American."

Price: $10 . . . . (All royalties go to the AAF Aid Society.)

Send your orders to Book Department, **SIGNALS, 804 17th Street, N.W., Washington 6, D.C.**

DUELL, SLOAN AND PEARCE

BOOK SECTION

THE SOVIET SPIES by Richard Hirsch. Duell, Sloan and Pearce. 92 pages. $1.00

Here is a fascinating account alleged by the author to be actual of the events leading up to the betrayal of the Soviets by Gouzenko, the Russian code clerk in Ottawa, Canada. It is fascinating reading—the kind that will appeal to the man or woman who enjoys mystery stories. But it teaches a lesson, too, that should interest all Americans. Of Dr. Allan May, the British scientist, the book says, "Dr. May is a symbolic figure in this tragedy of betrayals. He was not a vicious man, not a criminal, mountebank, charlatan, or adventurer. He had little appetite for conspiracy. He was a sober citizen whose passion for public honor led him to moral destruction and physical imprisonment. Read again May's apology: This was a contribution I could make to the safety of mankind." He, May, nuclear physicist, had presumed to decide in what direction lay the safety of mankind. No specialist in politics, he felt he knew better than the democratic governments where that safety lay. He did not act for profit but for the "safety of mankind."

S.H.S.

●

THEY ALMOST KILLED HITLER, prepared and edited by Gero v. S. Gaevernitz with an introduction by Major General William J. Donovan, formerly Chief of OSS. The Macmillan Company. 150 pages. $2.50

This is the factual history of the personal experiences of Fabian von Schlabrendorff, one of the handful of survivors who fought Hitler from within Germany. It reveals the inner conflict in Germany between Hitler and the German underground.

This book begins by describing the banding together of small groups of the intelligent men of Germany against the viciousness of the Third Reich. It shows the progression of the people, including high-ranking German officers, civil servants, scholars, industrialists, and labor leaders, as they left Hitler's ideals to band together, taking their lives into their own hands to fight Hitler and upholding the principles they believed best for Germany. The manner in which they infiltrated into high Army and civilian positions, and acted through them, is well portrayed. The constant fight between the old line Army officers and the young Hitler followers, and Hitler's personal way of making war is always in evidence and was used as an influence by these people.

von Schlabrendorff, a prominent German lawyer before the war, tells of the many unsuccessful attempts made on Hitler's life, finally leading up to the open attempted revolt against the Nazis on July 20, 1944, and how it failed. The important part which such high-ranking officers as Beck, Oster, vonKluge, Witzeleben and others of the German Army played, and their inevitable executions, is described well. For those who followed the general dissension of the German people, known to the allies during the war, this book closes the many gaps which heretofore were shrouded in hazy or secretive facts.

●

THE ATOMIC STORY, by John W. Campbell. Henry Holt and Company. 297 pages. $3.00

Since the dropping of the first atomic bomb on Japan there have been endless pieces of literature written concerning atomic power. Many of these were the result of highly imaginative minds, with little or no basis of facts, exploiting the interest of a suddenly atomic-conscious public. The remainder of these were usually of such a highly technical nature that the average person could find no interest in them. This is certainly *not* true of *The Atomic Story*.

This book brings out, step by step, the history of research, the race for atomic power during the war, and the implications for future use of atomic power, not only for destructive but also constructive use.

Mr. Campbell is in his own light an excellent portrayer of scientific material, having for many years been editor of a science fiction magazine. His scientific approach is based soundly and accurately on present day knowledge concerning the various aspects atomic power. The combination of both his ability to write interestingly on science and his sound basis of facts for the book makes it most interesting to read. The mystery surrounding the alpha and beta particles, gamma rays, nucleus, fission and other mysterious phrases melts into simple facts easily understood by even high school students. With this book as a basis, the ordinary man can talk and discuss atomic power with intelligence and fact.

●

FIFTH AVENUE, 100 photographs by Fred Stein, with introduction by Lawrence Grant White, and captions by Andy Logan of The New Yorker. Pantheon Books Inc. $4.00

Fred Stein, well-known photographer of *Paris,* the delightful calendar published 1944 by American Relief for France, has now focussed his camera on New York's famous Avenue. He has photographed its people and street scenes along with its architecture, in shots that bring out vividly the manifold use to which this street of shoppers, paraders, workmen and loiterers is put. The pictures lead from idyllic Washington Square through the busy downtown section, the elegant shopping center and dignified upper Fifth Avenue with its grandiose museums, splendid churches and monumental hospital buildings to the dismal slum fringe in which the world's most famous thoroughfare runs to its ragged end. In each section, however, children manage to have a very good time.

The fascinating and often amusing contrasts of cosmopolitan life.

its glamor and splendor, as well as its shoddiness and squalor are shown in skillful juxtaposition. Fifth Avenue thus becomes a paradigm of life itself.

THE STORY OF WAKE ISLAND, by Colonel James P. S. Devereux, USMC. J. B. Lippincott and Company, 252 pages. $2.75

Japanese attacked little Wake the day after Pearl Harbor, first with devastating bombing and then with substantial naval and ground forces. Immediately, this obscure atoll became a symbol of national tragedy and individual glory. The pathetically small garrison, by holding out for fourteen historic days and inflicting tremendous losses on the enemy, gave to the American spirit the kick that it needed. Our people gained the will to fight and the confidence in our ability to fight, and this was done, literally, "with the help of God and a few marines."

This *Story of Wake Island* was written by an American fighting man. It is not based on hearsay or gossip, and its author does not claim to reveal top echelon secrets. All Colonel Devereux knew was that he commanded the garrison on Wake Island when war broke out in the Pacific, and that it was his job to hold this island as long as it was humanly possible. He did so, and the enormously exciting story of how he did it provides the substance of his story.

Colonel Devereux has described in simple terms the seige of Wake Island, with full attention to the tragic aspects of it. He has told, at the same time, an absorbing adventure yarn with humor, action, and revealing vignettes of his men, their characters, their foibles, and their courageous attitude in the face of death and disaster.

Also included are illustrations, a map and an appendix containing a roster of marine, naval and army personnel engaged in the defense of Wake Island.

•

CHINA'S DESTINY, by Generalissimo Chiang Kai-shek; authorized translation by Wang Chung-hui. Macmillan Company. $2.75.

A history of the Chinese nation, an evaluation of her present problems and future needs and hopes—by her famed leader. Based on the revised edition of 1944, with original text in appendix.

THE GROWTH OF PHYSICAL SCIENCE, by Sir James Jeans. Macmillan Company. $3.75.

The connected story of scientific discoveries and theories, beginning with Babylonian mathematics, and ending with atomic science. The last book of the late, famed astronomer and author.

•

BUSINESS BUDGETING AND CONTROL, by J. Brooks Heckert. The Ronald Press Company: $5.00.

New treatment covering everything from principles through methods and procedures for the preparation and operation of budgets for all types of businesses, both large and small concerns.

•

FLASH PHOTOGRAPHY, by Gordon Parks. Franklin Watts, Inc. $1.25.

An up-to-the-minute, practical book on all phases of flash photography. Special emphasis has been placed on achieving natural lighting effects, and simple flash, multiple flash, out-door flash, equipment and its use are fully explained.

•

RUSSIAN-ENGLISH TECHNICAL AND CHEMICAL DICTIONARY, by Ludmilla Ignatiev Callaham. John Wiley and Sons, Inc. 794 pages. $10.00.

A scientifically organized reference to 80,000 terms, with a comprehensive coverage of organic and inorganic chemistry, and chemical technology and mineralogy.

•

AMERICAN FOREIGN SERVICE, by J. Rives Childs. Henry Holt and Company. $2.75.

A fascinating description of the origin and history of the Foreign Service of the United States, of its relations with other government departments, and of the day-by-day work of the Foreign Service officer. Includes chapters on both the French and British Foreign Service.

•

THE AVIATION ANNUAL OF 1947, Reginald M. Cleveland, Editor. Harper and Brothers. $5.00.

The year's significant development in aviation described by authorities in all branches of flying.

•

HOW TO BUY A HOUSE, by L. Douglas Meredith. Harper and Brothers, $2.50.

A thorough reference manual on the points to consider in house-buying.

•

THE FUTURE OF TELEVISION, By Orrin E. Dunlap, Jr. Harper and Brothers $2.50.

Revised and brought up to date both in its technical and performing phases.

•

SOLDIER'S ALBUM, by Colonel R. Ernest Dupuy and Lt. Colonel Herbert Bregstein. Houghton Mifflin Company. $5.00.

The story of the European war in pictures and text.

•

TALES OF THE SOUTH PACIFIC, by James A. Michener. Macmillan Company. $3.00.

Dramatic stories on one of the great adventures of our generation, told by a young naval officer. A forceful, moving book by a new writer of great promise.

THE WEB OF GOVERNMENT, by Robert M. Malver. Macmillan Company. $3.50.

Even before publication, this book has been called by one authority the most important work in the general field of government since Bryce's Modern Democracies.

•

GERMANY'S UNDERGROUND, by Allen Welsh Dulles. The Macmillan Company. $3.50.

An excellent over-all picture of the German anti-nazi movement—from Gestapo records, conversations, testimony at trials. Collected while Mr. Dulles was heading the O. S. S. in Switzerland.

•

THE WAYWARD BUS, by John Steinbeck. Viking Press. $2.75.

Steinbeck's first full-length novel in eight years, the story of a handful of characters on a bus, and their relations with each other during their hours together.

•

LYDIA BAILEY, by Kenneth Roberts. Doubleday. $3.00.

Best selling novel of colorful adventure in the early 1800's, by the author of Northwest Passage.

•

FIESTA AT ANDERSON'S HOUSE, by Scott G. Williamson. $2.75.

An American journalist decides to give a party at his landlord's home in Puerto Rico, and unwittingly brings together dangerously conflicting elements. A Hurricane outside is more than matched by the storm which rages inside the house.

•

HOLDFAST GAINES, by Odell and Willard Shepard. $3.00.

Major figures of early American history move through the surprising story of an Indian leader and his fight for his people.

•

KENNY, by Louis Bromfield. Harper and Brothers. $2.00.

Three short novels leading off with a natural: the story of an orphan boy growing up in Pleasant Valley countryside—a matchless combination of those qualities that have won Louis Bromfield a tremendous following among fiction and non-fiction readers alike.

•

PURITAN IMAGE, by Barbara Gilman. Doubleday and Company. $2.50.

A novel of New England snobbery and neurotic parenthood.

•

HOW GREEN WAS MY FATHER, by David Dodge. Simon and Schuster. $2.75.

This is a funny book about a wacky trip to Mexico. It contains a lot of fascinating dope (and 3 fascinating dopes), illustrations by Irving Koons, and uncountable smiles, chuckles and guffaws on every page.

•

THE VALLEY OF WILD HORSES, by Zane Grey. Harper and Brothers. $2.50.

All Zane Grey's incomparable skill, and all the pull of the canyon country are in this novel of a youth growing quickly ot manhood on the open range of the Southwest.

Letters TO THE EDITOR..

Sir:

". . . I have a copy of the sound motion picture of the presentation of 'Jimmie', which was very kindly given me before I left the United States . . .

"Shortly after I got back the nearest Signal unit put it on for the unit and my wife to see. I also had a shorter silent film of General Phillips' only visit to Camp Crowder. I gave a running commentary while that was shown and a short talk after the 'Jimmie' one. And needless to say I told them about General Ingles' marvelous remark to me—'Bill, you ARE one of the family'—at Fort Monmouth, where I thanked him for your and his tremendous kindness to me.

"My 3½ years in the United States were a really wonderful end to my army career and they were some of the very happiest years of my life. My only regret is that living on a pension will make it difficult to go back one day and see all my very good friends."

Brigadier W. C. Sykes
Royal Signals
Cortington, England

Sir:

"This will acknowledge your letter of 26 February 1947 and your offer to assist the Board in the preparation of its mobilization plans, as well as the booklet enclosed with the letter, is appreciated.

"Formation of Industry Advisory Committees is progressing slowly because of the great volume of work involved in setting them up. However, it is presumed that committees covering the field of industry which you represent will be established before the end of the year.

"The Board appreciates your interest in its mobilization planning and when the appropriate time comes we shall not hesitate to call upon your Association for assistance."

S. P. Spalding
Maj. Gen., U. S. A.
Dep. Exec. Chairman (Army)
Army & Navy Munitions Board

Sir:

"After having read the two copies of 'Signals' on file, here in the office, and the bulletins put out by the Association, I feel that finally a step has been taken in the right direction.

"Throughout the past seven and a half years of service, I have never found any publications by 'Signal men for Signal men,' nor any Association. However, the Infantry, Artillery and Cavalry Associations were, during this same period, keeping their personnel abreast of the latest tactical and technical trends of their respective branches.

"It is my opinion that, through the Army Signal Association, all members, be they on Active or Reserve status, will benefit greatly from the new developments and technical trends, that the Association will bring to their attention."

Harry L. Herres
Captain, Signal Corps

Sir:

"Down here in Rio de Janeiro we have welcomed and read with great interest the first two issues of 'Signals' . . . It is like a breath from home and is especially important here where we have only a small number of Signal officers to advise the Brazilian Army and our own staff and are expected to be up to date on all the latest commercial as well as military developments. Present here are the following: Major H. E. Maxwell, Captain B. T. Brown, Captain J. C. Deaver and myself.

"The Director de Transmissoes (Chief Signal Officer) of the Brazilian Army, Col. Armando Dubois Ferreira, has seen our copies of 'Signals' and expressed interest. We would like to present him with a subscription and are enclosing a check."

Robert B. Miller
Lt. Col., Sig. C.
Joint Brazil-U. S. Military Comm.

Sir:

"Your recent offer to assist the AAF in contacting industry in reference to the preparation of an industrial mobilization plan has been referred to the Industrial Planning Branch of the Army Air Forces, which has welcomed your gesture and states that your organization is the first of its type to volunteer this vitally needed assistance.

"At present the above named branch is in the midst of establishing an over-all policy for the program and is anxious to discuss and familiarize you with their progress to date as well as obtain any ideas that you may have in reference to the over-all industrial mobilization plan. In view of this, the Industrial Planning Branch will establish a possible date in the near future for the suggested discussion."

F. L. Ankenbrandt
Brig. Gen., U.S.A.
Air Communications Officer

Sir:

"I did appreciate receiving the copy of 'Signals' and your very kindly thought in remembering my visit to Fort Monmouth in 1944. That visit was one of the highlights of my tour, and I value your kindness to me very much. The Signal Depot at Monmouth is something to be very proud of, and an example to the world of how such an organization should be organized and administered.

"I keep in touch with General Akin at Tokyo and see your Army representatives here in Melbourne frequently. Please convey my very sincere greeting to him, General Ingles, Brigadier Generals Sarnoff and Arnold. "The bonds of friendship established during the war will endure forever and Australian Signals were very proud to cooperate with the U. S. Army Signal Corps and I am sure the traditions established during that period will never be forgotten, and will weld our two countries together in the future."

Colin T. Simpson
Major General
Australian Army
Middle Brighton
Victoria, Australia

Sir:

"I want to burden you with some of m thoughts in connection with the propose merger of the Armed Forces. I objec most strenuously to the choice of name 'Th Department of National Defense.' A grea man once said: 'There is more force i names than most men dream of.' Our ex perience with the unlimited use of thi word in 1940 and 1941 should have taugh us that the word 'defense' should never be so firmly imbedded into our governmenta structure that it becomes forever our policy This department will have the responsibility of conducting the wars which the State Department is either unwilling or unable to prevent. The State Department really is the defense organization. This new department should be named 'The War Department.' It will prepare the nation for wars and will conduct the wars. "In my judgment, there should be four Under-Secretaries: Under-Secretary for the Ground Forces, Under-Secretary for the Sea Forces, Under-Secretary for the Air Forces, and an Under-Secretary for the Service Forces.

"We will have to get the specification writers out of the different branches and bureaus, and out of the different Forces up under the Secretary of War. Standardization of engines, automotive equipment, heavy construction machinery, cannot be done at the lower levels. It has to be done at the top. Part of the waste is directly attributable to a reluctance to standardize between the Services."

Name withheld

On "Letters to the Editor":

"I regret to say the letter-writers have created a great ferment in the camp. The fact is that there never were such ridiculous and absurd letters written as have emanated from this great army since the battles. All that I have read have been a tissue of nonsense and falsehoods, so palpably absurd as to make me laugh, though others are greatly annoyed. For instance, I see one Captain ..... and Lieutenant ..... did wonders in the way of killing Mexicans, whereas it is well known that Captain ....behaved in a most equivocal manner, having been found in a quarry-hole, with his whole company, fifty men, guarding one poor Mexican prisoner, and harsh words had to be used to him before he could be gotten out of the hole, which was way in the rear of fighting, but where he was protected from the artillery sweeping the plain. ."As to Lieutenant ....., he was not in the fight at all, having been left at camp to guard the baggage. This is a fair specimen of the accuracy of most of the letter-writers . . . "I think, however, the dear public will be sadly puzzled to reconcile the thousand conflicting statements, and will finally have to throw themselves on the official reports, where alone is accuracy, divested of bombast and falsehood, to be found."

General George G. Meade
Mexican War

SCIENTIFIC DEVELOPMENTS

New Telephone Technique

A radically new technique which promises unique freedom from noise and interference in long-distance telephone communication has been developed at Bell Telephone Laboratories. It is known as PCM, an abbreviation for pulse code modulation.

Basically, PCM is a method of transmitting the human voice by various patterns, or codes, of electrical signals. Each pattern conveys certain information about the voice at a particular instant and from a succession of such patterns an entire conversation can be reconstructed.

The conversions from voice to pattern and back from pattern to voice—known as the coding and decoding processes—are accomplished electronically at almost unbelievable speeds. If enough patterns are used, these conversions can be made with incredible fidelity and so smoothly that the human ear is completely unable to detect the processing.

Although the new system is expected to be used primarily as an adjunct to the telephone network, it can also be used to transmit radio programs, pictures and teletypewriter signals.

Announcement of the new development was made on May 5 to the Union Radio Scientifique Internationale by W. M. Goodall of Bell Telephone Laboratories technical staff, one of several Bell engineers who have been working on various aspects of the project.

In announcing the new technique, Goodall said it "appears to have exceptional possibilities from the standpoint of freedom from interference." This is because it overcomes one of the most important difficulties of present long-distance systems, the building up of noise with each of the many amplifications needed for a long-distance telephone hookup. With PCM, this can be entirely eliminated by the use of special amplifiers in which the signal code is reconstructed during each amplification. Thus, no matter how many amplifiers are used, the PCM signal retains its original quality.

PCM is expected to find its greatest use in conjunction with pulse, or sampling, transmission over microwave radio relay communications systems on which not one, but many simultaneous conversations can be carried. In such transmission the continous speech wave is sampled very briefly and rapidly and only these small samples are transmitted. For a standard telephone circuit 3000 to 4000 cycles in width, samples taken at the rate of 8000 per second are adequate. Just these small samples are sufficient to reconstruct the original wave with high fidelity.

Since the sampling period can be so brief—roughly a millionth of a second—the system can carry not just one but many different conversation channels, each of which is sampled in turn and then reassembled at the receiving end. Thus, a transmission system of this type actually carries a sample from one conversation, then from another and so forth, repeating the sampling cycle through as many channels as are being transmitted.

A major problem in the development of this type of transmission has been to design dependable, noise-free methods of transmitting a description of these samples so that reliable information will be available at the receiving end for reconstructing the original conversation.

PCM accomplishes this without noise or distortion by using a set of patterns or codes, each one of which conveys specific information about the sample which it represents. Each of these patterns consists of an arrangement of electrical pulses.

The more patterns there are available, the more faithfully the voice wave can be reconstructed at the receiving end. Experiments have shown that patterns or code-groups using six or seven pulses assure high quality transmission.

In addition to outlining the general principles of PCM, Goodall also discussed an experimental system, the first ever built, which he designed some time ago. H. S. Black of the Bell Laboratories designed an eight-channel PCM system which used a five-pulse code affording 32 code-groups or patterns for sending information. It gave very satisfactory performance and freedom from interference during rigorous and extentive tests. A method of PCM has also been proposed by A. H. Reeves of the International Standard Electric Company.

Bell engineers believe it entirely practical to build a PCM system on which 100 telephone conversions could be carried at one time. Such a system, if it used a seven-pulse code-group, would transmit signals at the tremendous rate of 5,600,000 pulses per second.

Optiphone

Details of an ingenious wartime device which permitted telephone communication over a narrow beam of white or dark red light have recently been released by the Office of the Chief Signal Officer.

The equipment, developed by SCEL at Bradley Beach, N. J., was used successfully toward the end of the war by General Patton's Third Army. It was designed for use as telephone link equipment, or for point-to-point communication where laying of wire lines was impossible or impractical and where radio silence was necessary.

The "Optiphone" provides single-channel, two-way, break-in speech communication and consists of an optical unit, a control unit, a storage battery and a field telephone. The complete unit weighs 145 pounds. Optical range is up to four miles during daylight and up to seven miles at night with dark red filter, depending on atmospheric conditions. The field telephone is used directly with the equipment for point-to-point communication. When the Optiphone is used as a telephone link equipment, the telephone is used for monitoring purposes.

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Television—a Season Pass to Baseball!

Every home game—day or night—played by the New York Giants, Yankees and Brooklyn Dodgers will be seen over television this season!

Owning a television receiver in the New York area will be like having a season pass for *all three ball* clubs. And in other cities, preparations for the future telecasting of baseball are being made.

When more than one home game is on the air, baseball fans can switch from one to the other—see the most exciting moments of each through television!

Those who own RCA Victor television receivers will enjoy *brighter, clearer, steadier* pictures through the exclusive RCA Victor Eye-Witness picture synchronizer that "locks" the receiver in tune with the sending station.

To witness baseball or any other event in the ever-growing range of television programs—you'll want the receiver that bears the most famous name in television today—RCA Victor.

When you buy an RCA Victor television receiver or radio, or Victrola radio-phonograph, or an RCA Victor record or a radio tube, you know you are getting one of the finest products of its kind science has achieved. "Victrola" T.M. Reg. U.S. Pat. Off.

Radio Corporation of America, RCA Building, Radio City, New York 20. Listen to the RCA Victor Show, Sundays, 2:00 P.M., Eastern Standard Time over the NBC Network.

Several television cameras cover the baseball diamond to bring you a close-up of the action wherever it occurs. Here is a supersensitive RCA Image Orthicon television camera used by NBC's New York station WNBT in televising home games of the New York Giants.

RADIO CORPORATION of AMERICA

SIGNAL CORPS NEWS
FROM THE CHIEF SIGNAL OFFICER

Reeder Now Deputy CSO

Brigadier General W. O. Reeder, who served as Acting Chief Signal Officer from March 2 to March 31, has been designated Deputy Chief Signal Officer. He had been Acting Assistant Chief Signal Officer since August 15, 1946.

General Reeder served as Commandant of the Signal Corps School at Fort Monmouth, New Jersey, from July 1942 to June 1944, when he became Signal Officer of the China-Burma-India Theater. From May 1945 to January 1946, he served as G-4, India-Burma Theater and was subsequently named Field Commissioner, Office of the Foreign Liquidation Commission, India-Burma Theater. He served in that capacity until named Acting Assistant Chief Signal Officer.

General Reeder was awarded the Legion of Merit in 1944 for services from January 1941 to June 1944 as Assistant Commandant and Commandant, Eastern Signal Corps School at Fort Monmouth throughout the period of its expansion and reorganization.

Later he was awarded the Oak Leaf Cluster to the Legion of Merit for his work as Theater Signal Officer and later as Theater G-4, India-Burma Theater from June 24, 1944 to September 17, 1945.

General Reeder was born on May 15, 1897, at Allegheny, Pennsylvania, and was graduated from the U. S. Military Academy in 1917.

New Executive

Colonel Marion Van Voorst has been assigned as Executive, Office of the Chief Signal Officer, and Chief of the Administration Office. He succeeds Lt. Col. James W. Baldwin who has returned to civilian life.

Colonel Van Voorst, born in Monticello, Indiana, was graduated from the United States Military Academy in 1918. He attended the Coast Artillery School, the Signal School and Yale University between varied assignments in the United States and Panama.

For the past six years he was stationed in London as Assistant Military Attache and prior to that assignment was Chief of the Intelligence Division, Office of the Chief Signal Officer.

From September 1942 to May 1943, he was temporarily assigned to special duty with General W. S. Rumbough, Chief Signal Officer of the European Theater as a Brigadier General.

Assistant to War Secretary

Secretary of War Robert P. Patterson recently announced the appointment of Kenneth D. Johnson, Orleans, Massachusetts, as one of his Special Assistants.

A former District Court Judge of Quincy, Massachusetts, Colonel Johnson is a veteran of both World Wars. In 1917-1919, he was a private in Battery C, 103rd Field Artillery, 26th Division. In this last war, he served first with the Signal Corps in its Legal Division, and then went to Europe, to serve with SHAEF and OMGUS. He holds the Silver Star, the Legion of Merit and the Commendation Ribbon with two Oak Leaf Clusters.

Brigadier General Frank E. Stoner, former Assistant Chief Signal Officer who recently retired from the Army, has been named Chief Communications Engineer of the United Nations.

Cameras and Sound

An advanced on-the-job training course in the repair of cameras and sound projector equipment has been initiated at the Holabird Signal Depot in Baltimore according to a report received in the Office of the Chief Signal Officer. This is an innovation in Signal Corps procedure since this type of training has normally been conducted at one of the larger commercial concerns.

The Holabird Depot has established a well-equipped camera repair shop at which most of the Army's photographic equipment is repaired and returned to service.

The initial on-the-job class is limited to six Regular Army noncommissioned officers who have had some experience in the photographic field who, on graduation, are expected to be capable of instructing other Army personnel.

Integration

Thirty officers recently began visits to more than 150 American universities and colleges to describe to World War II officers due to graduate in June 1947 their opportunity to apply for Regular Army Commissions under the Integration Program.

Following the speaking teams, which consist of two officers each, one an AAF officer and the other from other arms and services—examining boards will begin to visit the same schools and all applicants for Regular Army commissions under the Program will be interviewed. Successful applicants will be nominated for commissions in September.

Medal for Wozencraft

Colonel Frank W. Wozencraft, Washington attorney who served with the Signal Corps during the war, was presented with the Legion of Merit by Major General Spencer B. Akin, Chief Signal Officer, at a recent ceremony in the Pentagon.

Colonel Wozencraft was cited for "exceptionally meritorious services" as Secretary to the Washington Communication Board; as Assistant Secretary, Joint Communications Board, and as Assistant Secretary for Communications, Joint Chiefs of Staff. He is a former mayor of Dallas, Texas, and a former president of the League of Texas Municipalities. During the war he was presented with the Order of the British Empire by Lord Halifax. He is a member of the Executive Board of the Boy Scouts of America and counsel for the Army Signal Association.

Midget with the "Magic Touch"...

Made by FEDERAL Associate of IT&T

ANOTHER outstanding Federal development, pioneered to fill a diversity of needs in the electronic and electrical industries, is the miniature Selenium Rectifier, orders for which reach into the millions. It sets a new standard of performance in all types of home radios, intercommunication systems, sun lamps, voice recorders, electric razors and the like—replacing the conventional rectifier tube. It eliminates warm-up, provides smoother operation, and lasts for the life of the instrument in which it is installed.

Wherever direct current is needed from an A. C. source, there's a Federal Selenium Rectifier to do the job. They safeguard industrial installations against costly corrosion, charge batteries and operate vital aircraft mechanisms. Federal Selenium Rectifiers were developed through I T & T research and first introduced in this country by the I T & T Manufacturing Subsidiary in the United States—Federal Telephone and Radio Corporation, Clifton, N. J.

Such new products prove again the leadership of the I T & T and associated companies in producing ever-finer equipment for industry . . . as well as for communications, television and radio.

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IT&T *serves the world in these eight additional ways:*

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I T & T has modernized and expanded national telephone networks in many countries, owns and operates 7 systems in Latin America and Shanghai, China.

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I T & T associates have 47,000 miles of submarine cable, 6600 miles of landline connections, over 60 international radiotelegraph circuits.

RADIOTELEPHONE COMMUNICATIONS

I T & T has installed and operates the radio stations connecting most of the countries of South America by radiotelephone with 95% of the telephones of the world.

RESEARCH AND DEVELOPMENT

I T & T research and development activities have been responsible for an outstanding record of contributions in the field of communications as well as electronics.

RADIO AIDS TO AERIAL NAVIGATION

I T & T companies, world-wide pioneers in radio navigation research, are today manufacturing and further developing electronic aids for safety in air transportation.

MARINE COMMUNICATIONS SALES AND SERVICE

I T & T associates operate 7 U. S. marine communications shore stations and have 152 sales-service agencies at principal world ports.

TECHNICAL AND ADVISORY SERVICES

I T & T technical and advisory services are supplied to certain government telephone systems as well as to privately owned telephone operating enterprises.

EXPORT

I T & T maintains an export department which supplies its customers their complete requirements of electrical equipment, including products of other manufacturers.

America's World-Wide Leader in Communications, Electronic Research and Precision Manufacture

N. G., O. R. C., R. O. T. C.

Signal ROTC Training

Five camp sites for the training of Advanced Signal Corps ROTC students during June have been designated. These sites are: Fort Monmouth, New Jersey, First and Second Army Area; Fort Benning, Georgia, Third Army Area; Fort Sill, Oklahoma, Fourth Army Area; Fort Riley, Kansas, Fifth Army Area; and Fort Lewis, Washington, Sixth Army Area.

Only those students who have completed the First Year Advanced Signal Corps ROTC are eligible to attend summer camp. The courses will stress individual leadership, field communications, and application of communication principles taught on the campus. Upon successful completion of summer camp, the students receive the balance of ROTC training at college. Upon completion of the ROTC course and the college curriculum, students may be offered commissions in the Signal Corps Reserve.

N. G. Units

Major General Butler B. Miltonberger, Chief of the National Guard Bureau, announced recently that the total of federally recognized National Guard units was 1,650 as of mid-April.

Oklahoma and Alabama have had all of their ground units inspected for federal recognition. Pennsylvania led the states in the total number of federally recognized units with 112, and Oklahoma was second with 109, Connecticut third with 74, Michigan fourth with 71, and Alabama fifth with 69.

Plans for the summer training of all ground units of the National Guard which are sufficiently organized, manned and equipped have been approved by the War Department. A 15-day field training period has been scheduled for all divisions and regimental combat teams whose integral units have been federally recognized by April 15. In order to be eligible, these units also must be self-sustaining in the field, must reach an aggregate strength equivalent to 30 per cent of their table of organization strength by May 15, and must be able to muster at least 20 per cent of their table of organization strength for the duration of the training period.

AUS and ORC

Officers on active duty are now authorized to receive commissions in the Officers Reserve Corps while remaining on active federal service in their AUS rank. They will be eligible for the highest Reserve Officers rank to which at present entitled. The new policy will affect approximately 50,000 officers in the Army from components other than Regular Army. Officers willl apply for the Reserve Officer Commissions on their own initiative, and will continue to serve on active duty in their Army of the United States appointments.

ORC Strength

Enrollment in the Organized Reserve Corps as of March 31, 1947, was approximately 503,230 officers and 630,000 enlisted personnel. On that date 2,978 units had been activated.

Equipment

The War Department intends to arm the National Guard with virtually every weapon used by the Regular Army, according to a recent announcement by the National Guard Bureau.

The present program calls for the equipping of the state military organizations with weapons, vehicles and personal equipment from the stocks of the wartime Army.

Standard equipment will include artillery up to 8-inch howitzers and 155-millimeter guns; armor of several categories, including light, medium and heavy tanks; all fire-control and detection equipment, including the various radar devices; bazooka weapons, and transport and construction equipment such as trucks, jeeps and bulldozers. The National Guard bureau hopes to supply all state units with Garand rifles and carbines, ending the use of the old Springfield rifle types.

Orientation

An orientation course for officers of all arms and services, except Air Forces, Medical Corps and Ordnance Department, detailed to ROTC units being activated July 1, 1947, will be conducted by the Commandant, The Ground General School, at Fort Riley, Kansas, June 23-27, General Jacob L. Devers, Commanding General, Army Ground Forces, announced recently.

Students will be those officers of Ground Arms and Technical Services except Medical and Ordnance Department, detailed to ROTC units being activated July 1, 1947. The size of the class reporting to the Ground General School on June 21, will be approximately one hundred and ten.

Officers detailed to duty with other ground ROTC units this year, will not attend an orientation course, but will receive their orientation "on the job."

Signal Guard Units

Most recent Signal National Guard units to receive Federal recognition are the 38th Signal Company, Indianapolis, Indiana; and the 113th Aircraft Control & Warning Squadron, Washington, D. C.

Aircraft Warning

The 113th Aircraft Warning and Control Squadron of Washington, D. C., is the first such unit to be Federally recognized and will also be the first to receive radar equipment. Five other similar Squadrons are expected to receive recognition within the next two months: the 103rd of Hartford, Conn.; the 117th of Birmingham, Ala.; the 127th of Romulus, Mich.; the 133rd of Des Moines, Iowa; and the 142nd of Portland, Ore.

"FIVE YEARS AGO IN SIGNALS"

May 6, 1942—Sergeant Irving Strobing, Signals Corps operator tapped out last tragic message from Corregidor as Japanese troops swarmed over the bastion.

May 15, 1942—The Signal Corps made contracts with Eastman Kodak for the world-wide operation of V-Mail. The photographic work of reducing original letters to microfilm dimensions and subsequently enlarging them was done at domestic installations. In combat zones the work was carried out by specially trained Signal Corps personnel. Between June, 1942, and August, 1945, the Signal Corps photographed 1,215,212,709 V-Mail letters.

May 15, 1942—The Signal Corps Replacement Training Center at Camp Crowder, Missouri, reported that since February 15, 1942, it had received 18,599 trainees from Reception Centers.

May 29, 1942—The new Signal Corps Depot at Lexington, Kentucky, was dedicated with Major General Dawson Olmstead, Chief Signal Officer, as principal speaker and with Governor Keen Johnson and Senator Alben W. Barkley among the guests.

June 3, 1942—Diplomas were presented by Brigadier General G. L. Van Deusen to 573 officer candidates at Fort Monmouth. This was the largest class in the history of the school up to that time.

June 10, 1942—In a move to centralize all meterological activities in the Office of the Chief Signal Officer under one head a Meterological Section was established in the Radar Division.

General Marshall, the new Secretary of State, who is reported as introducing new procedures into his department similar to those long practiced in the British Cabinet and our own Military General Staff System, found considerable progress had been accomplished in this direction when he assumed office. The military influence is strongest in the department's administrative activities since it is there that a considerable number of former military men may be found. The Chief of this setup is Assistant Secretary Peurifoy, a West Point graduate. Chief of the Division of Communications is Walter K. Scott who was a Lieutenant Colonel on the General Staff at SHAEF, while the Director of the Office of Departmental Administration is Carlisle Humelsine who was a Colonel on the General Staff at the Pentagon. ASA members will be especially interested to note the increase in efficiency already effected in message handling.

"1. In February, 1946, the department handled 4,980 telegrams, averaging 126 words, at a cost of $106,000. In November, it handled 5,264 telegrams, averaging 128 words, at a cost of $51,000.

"2. On November 2, 1945, the average time from receipt of a telegram until it was put in the hands of the proper official to act on it was 16 hours. This was cut to 3 hours and 12 minutes by last June and to 3 hours and 6 minutes last month.

"3. Similar handling time for "urgent" code messages was 6 hours in November, 1945. This was cut to 1 hour and 50 minutes last month."

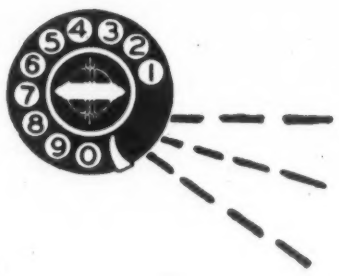
NOTES TO CHAPTERS

A number of our Chapters are considering their programs of activities for the months ahead. The War Department has just made available to us the services of speakers and the use of films, both of which can be of inestimable value.

Chapters desiring military speakers can, in most cases, meet their requirements by calling on the public relations officers of the appropriate Army area or Air Forces Command. When specific individuals are requested they will be assigned whenever circumstances permit. The subject of the address may be specified by the Chapter making the request, or left to the discretion of the speaker.

Requests for speakers from outside the Army areas or local Air command should be addressed to the Information Section, Headquarters, Army Ground Forces, The Pentagon, Washington 25, D. C., or to the Director of Information Army Air Forces, The Pentagon. To obtain speakers from among War Department officials, request should be sent to the Public Relations Division, War Department, The Pentagon.

For a period of two weeks any one of the near forty films the Army has available for non commercial, nonprofit showing, may be borrowed. These films were produced during the war, for the most part, primarily for use in training and orientation of military personnel. Some were produced entirely by the Signal Corps, some by the motion-picture industry, and some jointly by the two groups.



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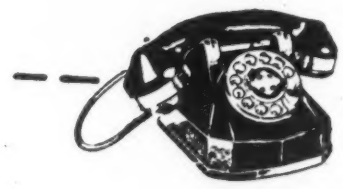

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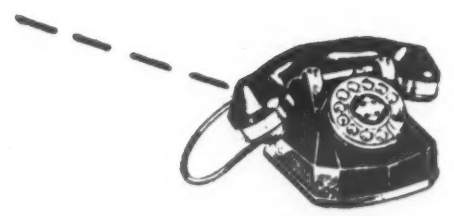

● For further information regarding Automatic Electric P-A-X, please address: Automatic Electric Sales Corporation, 1033 West Van Buren Street, Chicago 7, Ill.

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COMMUNICATION AND SIGNALING EQUIPMENT

CHANGES IN KEY PERSONNEL

UNDER ORDERS TO RETIRE

Brig. Gen. (former Maj. Gen.) Frank E. Stoner, effective 30 April.
Brig. Gen. Carroll A. Powell, effective 30 April.
Col. Frank H. Curtis, reverting to retired status, 31 May.
Col. Paul S. Edwards, effective 31 March.
Col. Joshua A. Stansell, effective 31 May
Col. George L. Townsend, effective 31 May

RECENT ASSIGNMENTS: OFFICE OF THE CHIEF SIGNAL OFFICER

Maj. Gen. Spencer B. Akin, appointed as Chief Signal Officer of the Army, effective 1 April.
Brig. Gen. William O. Reeder designated Deputy Chief Signal Officer, effective 1 April.
Col. (former Brig. Gen.) Marion Van Voorst assigned as Executive, OCSigO.
Col. Murray D. Harris, Procurement and Distribution Division.

RECENT ASSIGNMENTS: INSTALLATIONS UNDER JURISDICTION OCSigO

Col. Elton F. Hammond designated Commandant, SigC Schools, Ft. Monmouth.
Col. Reginald P. Lyman designated Asst. Commandant, Officers School, Ft. Monmouth.
Col. George L. Richon designated Asst. Commandant, Enl. Men's School, Ft. Monmouth.
Col. Louis J. Tatom appointed Commanding Officer, Army Electronics Standards Agency.
Col. John E. Kelsey, assigned Hq., Ft. Monmouth.

RECENT ASSIGNMENTS TO GROUND FORCES:

Col. Eugene A. Kenny, Hq., Fifth Army (upon return from overseas).
Col. Theodore T. Teague, Hq., Sixth Army.

OVERSEAS ASSIGNMENTS:

Col. Eugene V. Elder, ETO.
Brig. Gen. J. V. Matejka.

MISCELLANEOUS

Announcement has been made of the appointment of Col. James W. Green, Jr., as Professor of Electricity, United States Military Academy.

Col. Hugh Mitchell has been relieved from Fort Monmouth and assigned to the Army Air Forces, with station at Cambridge Field Station, Mass.

Col. Kenneth F. Zitzman, now assigned USMA, will be assigned to Research and Development Division, War Dept. Gen. Staff about 1 September.

OFFICERS SCHEDULED TO ATTEND SERVICE SCHOOLS

NATIONAL WAR COLLEGE

Col. (former Brig. Gen.) W. Preston Corderman

INDUSTRIAL COLLEGE OF THE ARMED FORCES

Col. Wm. L. Bayer
Col. Thomas J. Cody
Col. Frank W. Moorman
Col. George F. Moynahan, Jr.
Col. Wm. P. Pence
Col. Francis F. Uhrhane
Lt. Col. Arthur A. McCrary

ARMED FORCES STAFF COLLEGE

Col. Earle F. Cook
Col. Benjamin H. Pochyla
Lt. Col. Wm. Scandrett

COMMAND AND STAFF COLLEGE

Lt. Col. Orman G. Charles
Lt. Col. Homer L. Davis, Jr.
Lt. Col. Wm. B. Feindel, Jr.
Lt. Col. James H. Fulton
Lt. Col. Wm. E. Heltzel
Lt. Col. Will D. Joslin
Lt. Col. Francis L. Mayer
Lt. Col. Herman L. Purkhiser
Maj. Deane A. Dunloy
Maj. John H. Green
Maj. Lassiter A. Mason
Capt. James E. Foster

TRANSFER IN BASIC BRANCH

	From	To
Col. Donald H. Nelson	Cav.	SC
Col. Raymond C. Maude	SC	AC
Col. Alvin L. Pachynski	SC	AC
Col. James E. Totten	SC	AC
Col. Victor H. Wagner	SC	AC
Col. John B. Bestic	SC	AC
Col. Chas. J. Harrison	SC	AC

"World War II cost this country . . . 300,000 dead, twice the number disabled. The national debt went up from $43 billions to $270 billions. For the sake of our future safety, I hope that the lessons learned in those war years will not be forgotten or neglected".—Hon. Robt. P. Patterson, Secy. of War.

"The Army is an instrument of our national defense. It has been, since the time of George Washington, the servant of the people, subordinate at all times to the civil power."—Hon. Robert P. Patterson, Secy. of War.

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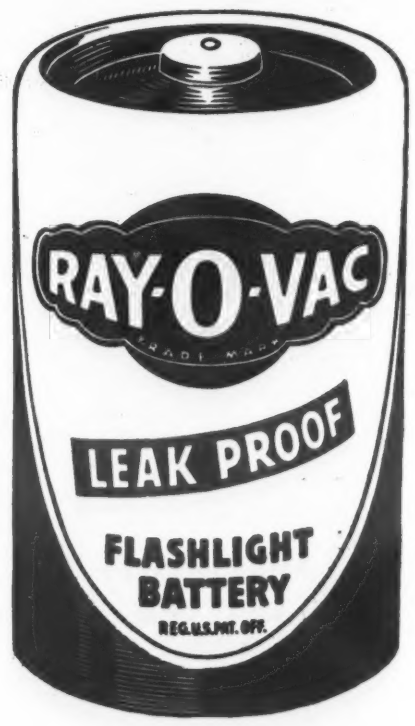

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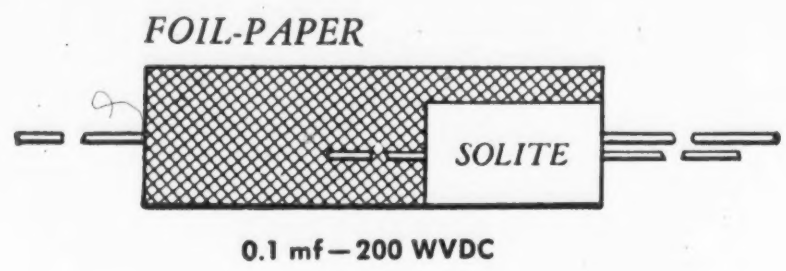
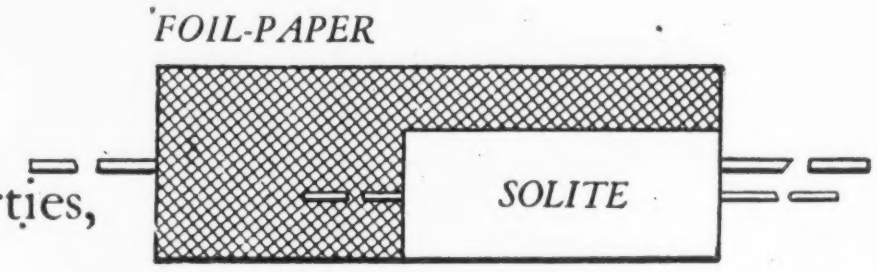
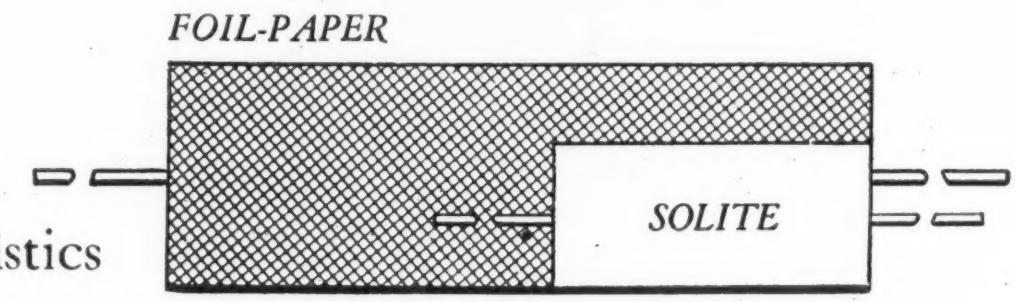


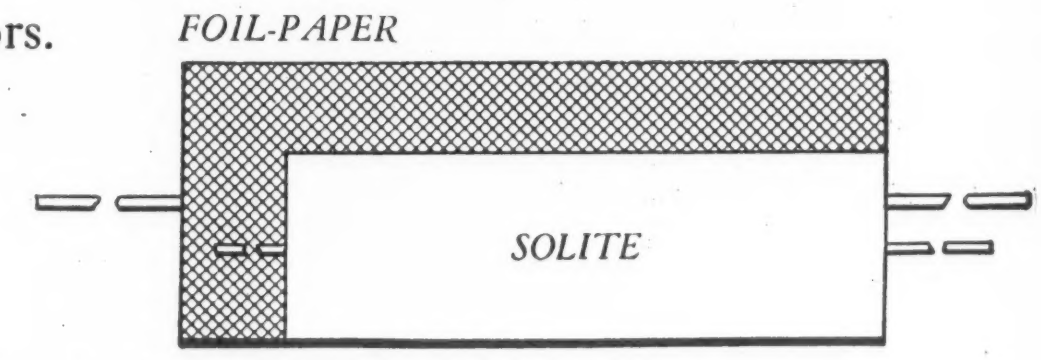
0.1 mf—200 WVDC



0.5 mf—200 WVDC



1.0 mf—200 WVDC



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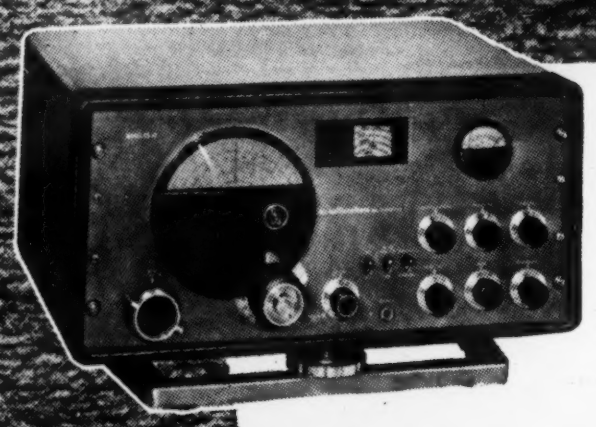
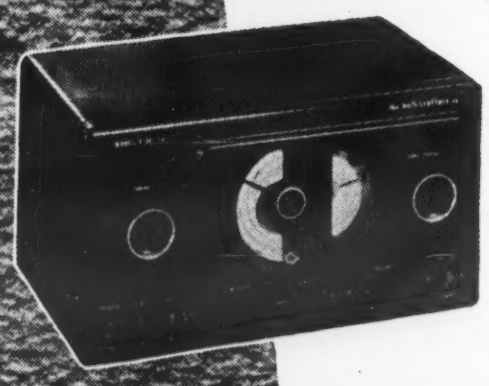
3 GREAT RECEIVERS DESIGNED AND BUILT FOR HAMS WHO ARE GOING PLACES AGAIN



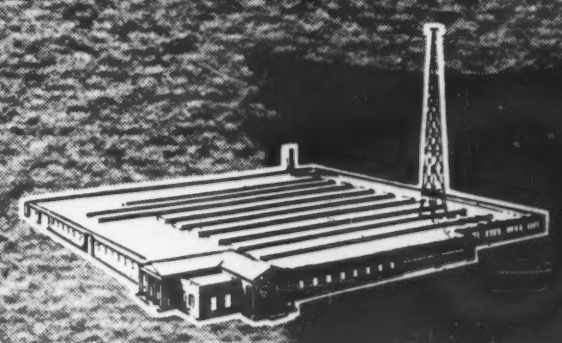
***Model* SX-42** Described by hams who have operated it as "the first real postwar receiver." One of the finest CW receivers yet developed. Greatest continuous frequency coverage of any communications receiver—from 540 kc to 110 Mc, in six bands. FM-AM-CW. 15 tubes. Matching speakers available. **$275.00**

***Model* S-40A** Function, beauty, unusual radio performance and reasonable price are all combined in this fine receiver. Overall frequency range from 540 kc to 43 Mc, in four bands. Nine tubes. Built-in dynamic speaker. Many circuit refinements never before available in medium price class. **$89.50**



***Model* S-38** Overall frequency range from 540 kc to 32 Mc, in four bands. Self contained speaker. Compact and rugged, high performance at a low price. Makes an ideal standby receiver for hams. CW pitch control is adjustable from front panel. Automatic noise limiter. **$47.50**

Prices slightly higher in zone 2



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